

Mather Air Force Base

Final

Second Five-Year Review of Remedial Actions

Conducted Under the

Comprehensive Environmental Response,
Compensation, and Liability Act

September 24, 2004

Air Force Real Property Agency



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105**

November 24, 2004

Mr. Greg Gangnuss
AFRPA/DD
3411 Olson Street, #105
McClellan Air Force Base, CA 95652

Subject: Second Five-Year Review of Remedial Actions at Mather Air Force Base, California

Mr. Gangnuss:

The U.S. Environmental Protection Agency (EPA) has completed review of the subject document dated September 24, 2004. The document was well-written and comprehensive; EPA has no comments on the document.

EPA agrees that "the results of this review indicate that the actions taken to address immediate health and environmental risks under the first five operable units at Mather Air Force Base are consistent with the remedial actions selected in the CERCLA records of decision for the sites, as modified for several sites by later Explanation of Significant Difference documents, and that the remedial actions at sites where contamination remains on site during the remedy are protective of human health and the environment." While EPA agrees that the remedies selected are considered protective in the short term, in order for the remedies to remain protective in the long term, the following must be completed:

Institutional controls (ICs) where not established through existing records of decision (RODs) should be put in place through either a ROD amendment or an Explanation of Significant Differences (ESD). As Mather is a Base Closure and Realignment Act site, the U.S. Air Force (USAF) cannot rely on property ownership as a long-term IC, nor can local ordinances be cited as providing long-term protection of public health and the environment.

The USAF is commended for the installation of extraction well EW-12B in the Main Base/SAC Industrial Area Plume and should continue developing an evaluation of remedy performance once this well is established within the overall extraction and treatment system for this plume.

Due to the ubiquitous low-level detections of perchlorate in the Main Base/SAC

Industrial Area Plume effluent, the USAF should develop a plan for the continued monitoring of perchlorate in ground water at Mather.

Agreements for wellhead treatment at the Moonbeam and Juvenile Hall public water supply wells should remain in effect as per the Off-Base Water Supply Contingency Plan.

While it is understood that current land uses in the off-post portions of the Site 7 Plume have caused disruptions in remedial actions, the USAF should resume operations in as expedient a manner as possible and determine the effectiveness of the pump and treat system operation on plume containment and/or ground-water restoration prior to the next five-year review.

The USAF should consider the appropriateness of monitored natural attenuation (MNA) as the remedy for the Northeast Plume through an extensive evaluation of the monitoring data; if the data support MNA as the long term remedial action as per EPA guidance, the USAF should develop an ESD for this site.

If you have any questions regarding these comments, please contact Rich Muza of my staff at 415-972-3349.

Sincerely,

A handwritten signature in black ink, appearing to read 'Kathleen Johnson', written in a cursive style.

Kathleen Johnson, Chief
Federal Facility and Site Cleanup Branch

cc: Carolyn Tatoian-Cain, DTSC
Karen Bessette, RWQCB
Bill Hughes, CSC
Thelma Estrada, ORC

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (from WasteLAN): Mather Air Force Base		
EPA ID (from WasteLAN): CA8570024143		
Region: IX	State: CA	City/County: Sacramento County
SITE STATUS		
NPL Status: <input checked="" type="checkbox"/> Final <input type="checkbox"/> Deleted <input type="checkbox"/> Other (specify) _____		
Remediation Status (choose all that apply): <input checked="" type="checkbox"/> Under Construction <input type="checkbox"/> Operating <input type="checkbox"/> Complete		
Multiple OUs?* <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Construction completion date: __/__/____
Has site been into reuse? <input checked="" type="checkbox"/> YES <input type="checkbox"/> No		
REVIEW STATUS		
Lead agency: <input type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input checked="" type="checkbox"/> Other Federal Agency		
Author name: William T. Hughes, R.G., C. HG		
Author Title: Project Manager		Author affiliation: Computer Sciences Corp.
Review period:** __/__/__ to __/__/__		
Date(s) of site inspection: Ongoing on-site presence		
Type of review: <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div> <input type="checkbox"/> Post -SARA <input type="checkbox"/> Pre-SARA <input type="checkbox"/> Non-NPL Remedial Action Site <input type="checkbox"/> Regional Discretion </div> <div> <input type="checkbox"/> NPL-Removal only <input type="checkbox"/> NPL State/Tribe-lead </div> </div>		
Review number: <input type="checkbox"/> 1 (first) <input checked="" type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify)		
Triggering action: <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div> <input type="checkbox"/> Actual RA Onsite Construction at OU # ____ <input type="checkbox"/> Construction Completion (PCOR) <input type="checkbox"/> Other (specify) </div> <div> <input type="checkbox"/> Actual RA Start at OU# ____ <input checked="" type="checkbox"/> Previous Five-Year Review Report </div> </div>		
Triggering action date: (from WasteLAN): __/__/__		
Due date (five years after triggering action date): __/__/__		

["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

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List of Acronyms

AAFES	Army Air Force Exchange Service
AC&W	Aircraft Control and Warning
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFRPA	Air Force Real Property Agency
AGE	Aerospace Ground Equipment
ARAR	Applicable or Relevant and Appropriate Requirement
ATC	Air Training Command
AVGAS	Aviation Gasoline
BCT	BRAC Cleanup Team
BCRA	Base Closure and Realignment Act
BE	Bioenvironmental
BRAC	Base Realignment and Closure
CCR	California Code of Regulations
CE	Civil Engineering
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CVRWQCB	Central Valley Regional Water Quality Control Board
DCA	Dichloroethane
DCP	Dichloropropane
DCE	Dichloroethene
DD	Drainage Ditch
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyltrichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DTSC	Department of Toxic Substances Control
EA	EA Engineering, Science, and Technology
EPA	Environmental Protection Agency
ESD	Explanation of Significant Difference
FAA	Federal Aviation Administration
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FR	Federal Register
FR	Firing Range (IRP site designation)
FT	Fire Training (IRP site designation)
gpm	gallons per minute
ID	Identification
ILCR	Incremental Lifetime Cancer Risk
ILS	Instrumented Landing System
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IT	International Technology

List of Acronyms (Continued)

ITIR	Informal Technical Information Report
IWMB	Integrated Waste Management Board
JP-4	Jet Propellant fuel
LF	Landfill (IRP site designation)
LTO&M	Long-Term Operations and Maintenance
MAFB	Mather Air Force Base
Mather	Mather Air Force Base
MCL	Maximum Contaminant Level
mg/l	Milligrams per Liter
MWH	Montgomery Watson Harza
N/A	Not Applicable
NPL	National Priorities List
ND	Non-Detect
NO	Number
NFA	No Further Action
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OPS	Operating Properly and Successfully
OSWER	Office of Solid Waste and Emergency Response
OT	Other (IRP site designation)
OU	Operable Unit
OWS	Oil/Water Separator
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Perchloroethene (Tetrachloroethene)
PHG	Public Health Goal
PNA	Polynuclear Aromatic
POL	Petroleum, Oil, and Lubricant
POTW	Publicly Owned Treatment Works
ppb	parts per billion
ppm	parts per million
ppmv	parts per million by volume
ppt	parts per trillion
PRG	Preliminary Remedial Goal
RA	Remedial Action
RAB	Restoration Advisory Board
RAM	Removal Action Memorandum
RAR	Remedial Action Report
RI	Remedial Investigation
RI/FS	Remedial Investigation Feasibility Study
RPM	Remedial Project Manager
ROD	Record of Decision
RW	Radioactive Waste (IRP site designation)

List of Acronyms (Continued)

RWQCB	Regional Water Quality Control Board
SAC	Strategic Air Command
SCEMD	Sacramento County Environmental Management Department
SMAQMD	Sacramento Metropolitan Air Quality Management District
SD	Storm Drain (IRP site designation)
SS	Sanitary Sewer (IRP site designation)
ST	Storage Tank (IRP site designation)
SVE	Soil Vapor Extraction
TBD	To Be Determined
TCA	Trichloroethane
TCDD	Tetrachlorodibenzo-p-dioxin
TCE	Trichloroethene
TPH	Total petroleum hydrocarbons
TPH-d	Total petroleum hydrocarbons reported as diesel
TPH-g	Total petroleum hydrocarbons reported as gasoline
ug/l	Micrograms per Liter
USAF	United States Air Force
U.S. EPA	United States Environmental Protection Agency
USC	United States Code
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WP	Waste Pit (IRP site designation)
yd ³	Cubic Yards

1.0 INTRODUCTION

1.1 Statement of Authority and Purpose

The Air Force Real Property Agency (AFRPA) conducted this review pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c); 40 Code of Federal Regulation (CFR) 300.400(f)(4)(ii); Executive Order 12580; and the Office of Solid Waste and Emergency Response (OSWER) Directives 9355.7-02 (U.S. EPA, 1991a), 9355.7-02A (U.S. EPA, 1994), and 9355.7-03A (U.S. EPA, 1995). This report provides reviews required by statute on three landfill sites and a skeet range site, for which remedies are in place but at which contamination remains, and reviews recommended by U.S. EPA policy at 11 other sites and four other groundwater plumes where remedial action is in progress and may take more than five years to complete, on the former Mather Air Force Base (Mather), near Sacramento, California. The purpose of a five-year review is to ensure that remedial actions remain protective of public health and the environment and are functioning as designed. This report will become a part of the Administrative Record for each site for which a five-year review is herein documented.

This five-year review report summarizes the status of actions taken pursuant to Records of Decision (RODs) for five operable units (OUs) at Mather, Sacramento County, California. The review also summarizes the status of the sites in the sixth OU, for which the ROD was in preparation at the time of the review. This five-year review is required under CERCLA. The purpose of the review is to determine if remedial response actions are protective of human health and the environment, and to make recommendations to attain or maintain protectiveness. This review was conducted by the Air Force Base Conversion Agency under Executive Order 12580, which delegates review responsibility to federal facilities at which the sole source of the release is under the control of the facility. The review is the second five-year review done at Mather, and was initiated in 2003 to meet the completion due date of June 2004.

1.2 Statutory Requirements and Guidance for Five-Year Reviews

The statutory requirement for five-year reviews is found as part of the Comprehensive Environmental Response, Compensation, and Liability Act, and is found at *42 United States Code (USC) Section 9621(c) (January 16, 1996)*:

Review

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after the initiation of such remedial action to assure that human health and the environment are being protected by the

remedial action being implemented In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 9604 or 9606 of this title, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

This requirement is also included in the United States Environmental Protection Agency (U.S. EPA) regulations found at 40 CFR 300.430(f)(4)(ii) (as of July 1, 1997):

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action.

The United States Environmental Protection Agency (US EPA) guidance found in OSWER document 9355.7-03B-P (U.S. EPA, 2001b) provides guidance for five-year reviews conducted by U.S. EPA and has been used to guide the current review at Mather. This guidance document supercedes earlier U.S. EPA guidance documents (U.S. EPA, 1991a, 1991b, 1994, and 1995) and updates related content of other guidance (U.S. EPA, 1999).

1.2.1 Timing of the Review

The U.S. EPA or other responsible federal agency should complete a statutory review within five years of the initiation of the first remedial action at a federal-lead site. The Air Force, as lead agency responsible for conducting the environmental remediation at Mather, has conducted this review. Concurrence by U.S. EPA and the State of California is indicated by signature in Section 7.0. The timing of Mather's review was dictated by the date established for the previous five-year review, which in turn was determined by the start of construction on the remedial action for the Aircraft Control and Warning (AC&W) Site, the sole site requiring remedial action in the AC&W Operable Unit (OU), on June 29, 1994. The completion date for this review was therefore June 29, 1999. Upon issuance of the review report on June 29, 1999, the remedial project managers (RPMs) from the State of California requested an additional review cycle. This was agreed to by the RPMs from the Air Force Base Conversion Agency (AFBCA; now the Air Force Real Property Agency, AFRPA) and the U.S. EPA. The final revision (AFBCA, 1999c) was prepared to address additional comments found in Appendix B of that report.

In accordance with Section 27.3 of the Federal Facilities Agreement for Mather Air Force Base, and consistent with OSWER Directive 9355.7-03B-P (U.S. EPA, 2001b), this review covers all operable units at Mather.

The Federal Facility Agreement (FFA) for Mather Air Force Base, also called the Interagency Agreement, was signed in July 1989 by the Air Force, U.S. EPA, and the State of California. The FFA contains the following in Section 27:

27. FIVE YEAR REVIEW

27.1 Consistent with 42 U.S.C. Section 9621(c) and in accordance with this Agreement, if the selected remedial action results in any hazardous substances, pollutants or contaminants remaining at the Site, the Parties shall review the remedial action program at least every five years after the initiation of the final remedial action to assure that human health and the environment are being protected by the remedial action being implemented

27.2 If, upon such review, any of the Parties proposes additional work or modification of work, such proposal shall be handled under Subsection 7.1.0 of this Agreement.

27.3 To synchronize the five year reviews for all operable units and final remedial actions, the following procedure shall be used: Review of operable units will be conducted every five years counting from the initiation of the first operable unit, until initiation of the final remedial action for the Site. At that time a separate review for all operable units shall be conducted Review of the final remedial action (including all operable units) shall be conducted every five years, thereafter.

The remedial project managers for Mather prepared a consensus statement agreeing to conduct the second five-year review by June 29, 2004, and subsequent five year reviews every five years thereafter, superseding the requirement 27.3 in the Mather FFA.

1.2.2 Statutory and Policy Reviews

U.S. EPA distinguishes between statutory five-year reviews, and policy reviews. Statutory five-year reviews are required by statute for, all sites for which a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure. Policy reviews are conducted by U.S. EPA (U.S. EPA, 2001b), at sites which upon completion of remedial action will allow unlimited use and unrestricted exposure, but which will require at least five years to attain the cleanup levels specified in the ROD. This review identifies the sites at Mather that fit EPA's definitions for statutory or policy reviews. However, the five-year review is the same, regardless of whether it is required by statute, or identified in EPA guidance as a site to be reviewed as a matter of policy.

1.3 Scope and Nature of Current Five-Year Review

This five-year review addresses all the Installation Restoration Program (IRP) sites at Mather that trigger either a statutory review or a policy review, and summarizes the status of all other IRP sites at Mather as well. The sites which require statutory reviews are sites 3, 4, 7, which are landfills in either the Landfill Operable Unit (OU) or the Basewide OU; and Site 87, a skeet/trap range in the Basewide OU, where lead remains in soil at the site above a concentration that allows for unlimited use and unrestricted exposure. One other site will require statutory review in the future. Site 89 is a former trap range in the

Supplemental Basewide OU, for which cleanup by removal action has been conducted, but for which the ROD has not been completed at the time of this review. It, like Site 87, has lead remaining in soil at the site above a concentration that allows for unlimited use and unrestricted exposure. Therefore, Site 89 will require a statutory review during the next five-year review at Mather. Site 89 information is summarized in this review.

A summary list of Mather's Installation Restoration Program (IRP) sites, their remediation status, and the type of five-year review (if any) they received is presented in Table 1.

This five-year review was conducted by evaluating the status and performance of remedial actions taken to date, and determining if those actions meet or demonstrate progress consistent with meeting the specific goals and objectives stated in the ROD for each site. For the landfill sites where the landfill cap and institutional controls provide the protectiveness, this review focuses on the integrity of the cap and the controls. For sites undergoing groundwater or in situ treatment, this review addresses whether the technologies chosen in the remedial action are still appropriate.

1.4 Findings of the Five-Year Review

The results of this review indicate that the actions taken to address immediate health and environmental risks under the first five operable units at Mather Air Force Base are consistent with the remedial actions selected in the CERCLA records of decision for the sites, as modified for several sites by later Explanation of Significant Difference documents, and that the remedial actions at sites where contamination remains on site during the remedy are protective of human health and the environment.

The specific goals stated in each ROD have been met or progress toward meeting the goals is on schedule. Since the last five-year review, corrective action to control landfill gas at Site 4 was implemented in 1998, and monitoring of gas concentrations documents that concentrations are below the limit of five percent (5%) methane at the site boundary.

Section 6.0 contains recommendations addressing both unresolved issues raised in the 1999 Five Year Review, and those raised in conjunction with this review. The 1999 concerns were the adequacy of institutional controls to mitigate potential exposure to contamination from Mather, and the identification of additional contaminants of potential concern that may be identified during soil vapor extraction monitoring. As a result of the 1999 review, the Air Force recommended to amend the Record of Decision for the AC&W OU to add institutional controls to the remedial action for the AC&W groundwater plume. In addition the Air Force proposed to evaluate additional contaminants of potential concern prior to shutting off any of the soil vapor extraction systems at Mather. The former has not been accomplished, because the remedial project managers have not agreed on the level of detail about institutional controls to be included in decision documents. The Draft Final Supplemental Basewide Operable Unit ROD has been in dispute since 2001. Concerns raised by regulatory agency representatives during this review included risk estimates for contaminant exposure using a proposed U.S. EPA

cancer slope factor for TCE; evaluating indoor air exposure pathways; consideration of updates to regulations implementing the National Pollutant Discharge Elimination System as applicable or relevant and appropriate requirements under CERCLA; and consideration of regulation allowing the State to enter into land use covenants as applicable or relevant and appropriate requirements under CERCLA.

TABLE 1: IRP Five-Year Review Status					
Site ID	Site Description	OU	Requirement for Review Statutory Policy		Notes
LF-01	Runway Overrun Landfill (LF)	4			No Further Action (NFA)
LF-02	“8150” Area Landfill	4			Landfill waste moved to Site 4. Closed; Remedial Action Report (RAR) concurrence 9/00
LF-03	Northeast (N.E.) Perimeter Landfill Number (No). 1	4	X		Cap in place; in Long-Term Operation and Maintenance (LTO&M)
LF-04	N.E. Perimeter Landfill No. 2	4	X		Cap in place; in LTO&M
LF-05	N.E. Perimeter Landfill No. 3	4			Groundwater Monitoring
LF-06	Firing Range Area Landfill Sites	4			Groundwater Monitoring
WP-07	“7100”Waste Pit (WP) Area Disposal Site	3	X		In situ treatment Cap in place; in LTO&M
FT-08	Former Fire Training (FT) Area 1	5			NFA
FT-09	Former Fire Training Area 2 (Used 1945 to 1947)	3			NFA
FT-10	Former Fire Training Area 3 (Used 1947 to 1958)	3			NFA
FT-10C	Fire Training Area 3 (Revised location)	5		X	In situ treatment
FT-11	Existing Fire Training Area (Used 1958 to 1993)	3		X	In situ treatment
WP-12	Aircraft Control and _ Warning Site	1		X	Operating Properly and Successfully (OPS) concurrence November 1998
SD-13	Storm Drain (SD) Drainage Ditch No. 1 (east of Facility 2950)	3			Excavation of ditch sediment and surface soils; Closed with RAR concurrence 9/00

TABLE 1: IRP Five-Year Review Status					
Site ID	Site Description	OU	Requirement for Review Statutory Policy		Notes
SD-14	Drainage Ditch Number (No). 2 (northeast of Facility 3975)	3			NFA
SD-15	Drainage (West) Ditch No. 3, incl. Oil/Water Separator (OWS) Facility 7039	3			Excavation of ditch sediment; Closed with RAR concurrence 9/01
RW-16	Radioactive Waste (RW) Electron Tube Burial Site under Facility 8170	3			NFA
WP-17	Weapons Storage Area Septic Tank (south of Facility 18080)	5			NFA
LF-18	Old Burial Site (north of Facility 4120)	5		X	In Situ Treatment
WP-19	Fuel Tank 4015 & Sludge Burial Site (near Facility 4012)	3*			* selected for no further action under CERCLA; Closed by Regional Water Quality Control Board (RWQCB) letter 2/22/02.
ST-20	Sewage Treatment Plant Underground Storage Tank (UST) and Sludge Drying Beds	3/5			CERCLA closure pending. UST closure letters from Sacramento County Environmental Management Department (SCEMD) 6/17/87 & 6/15/98. RWQCB concurrence letter 5/15/98.
OT-21	Asphalt Rubble Storage Site (Other OT) (northeast of Facility 7125)	3			NFA
OT-22	Asphalt Rubble Storage Site (adjacent to Nav Rd.)	3			NFA
OT-23	Main Base Sanitary Sewer System	5		X	In Situ Treatment

TABLE 1: IRP Five-Year Review Status					
Site ID	Site Description	OU	Requirement for Review Statutory Policy		Notes
ST-24	Jet Propellant fuel (JP-4) Spill Site at SAC Aircraft Parking Apron	3			NFA
ST-25	Former UST for Emergency Generator, Facility 10100	1			NFA
ST-26	Former UST for Instrumented Landing System (ILS) Localizer Emergency Generator, Facility 10072	3			NFA
ST-27	Former UST for Communications Transmitter Emergency Generator, Facility 10060	3			NFA
ST-28	Former UST for Water Supply Emergency Generator, Facility 16100	3			NFA
ST-29	4 Former UST at Military Gas Station, Facility 3167	3*			*selected for no further action under CERCLA but remains to be closed under other regulations; Soil Vapor Extraction (SVE) operating
ST-30	Former UST Security Police Emergency Generator, Facility 10300	1			NFA
ST-31	Former UST Transmitter Emergency Generator, Facility 10090	3			NFA
ST-32	6 Former UST at Army Air Force Exchange Service (AAFES) Service Station, Facility 2410	3*			*selected for no further action under CERCLA. Closed by RWQCB letter 4/15/97.

TABLE 1 (continued): IRP Five-Year Review Status					
Site ID	Site Description	OU	Type of Review Statutory Policy		Notes
ST-33	6 Former USTs at Civil Engineering (CE) Paint Shop, Facility 3308	3			NFA
ST-34	5 Former USTs at AAFES Service Station, Facility 21030	3*			*selected for no further action under CERCLA Closed by RWQCB letter 11/00.
ST-35	4 Former USTs at Petroleum, Oil and Lubricant (POL) Yard 1, Facility 3226	3*			*selected for no further action under CERCLA but remains to be closed under other regulations; SVE operating.
ST-36	4 Former USTs at Old Rail Yard 2, Facility 3286	3*			*selected for no further action under CERCLA but remains to be closed under other regulations; SVE operating.
ST-37	5 Former USTs at Bioenvironmental (BE) Storage Yard, Facility 3389	3		X	In Situ Treatment
ST-38	2 Former USTs at BE Storage Yard, Facility 3388	3			NFA
ST-39	8 Former USTs at Hazardous Waste Storage Facility 4305	3		X	In Situ Treatment
ST-40	Former UST for Training Classroom Boiler, Facility 3875	3			Closed by SCEMD letter 1/22/91.
ST-41	2 Former USTs at Old Motor Pool, Facility 2995	3			Closed by SCEMD letter 1/22/91.
ST-42	Former UST at Old Motor Pool, Facility 2898	3			Closed by SCEMD letter 1/22/91.
ST-43	2 Former USTs Water Supply Emergency Generator, Facility 10150	3			Closed by SCEMD letters 1/22/91 & 10/8/96.

TABLE 1 (continued): IRP Five-Year Review Status					
Site ID	Site Description	OU	Type of Review Statutory Policy		Notes
SD-44	Former OWS at old Weapons Storage Area, Facility 8540	3			Closed by SCEMD letter 1/22/91.
ST-45	Former Ammonia UST for Missile Facility, Facility 7003	3			Closed by SCEMD letter 1/22/91.
ST-46	Former UST for Alert Crew Emergency Generator, Facility 8158	3			Clean closure letters from SCEMD 6/27/96 & 6/28/96.
ST-47	Former UST near Security Police Facility 10400B	1			SCEMD closure letter 10/8/96.
ST-48	Former UST for Security Police Facility 10410	3			NFA
ST-49	Former UST for Security Police Facility 10450	3			NFA
ST-50	Same as ST-34	N/A			
ST-51	Former UST for Instrumented Landing System (ILS) Glide Slope Generator Facility Emergency 10030	3			NFA; Clean closure letters from SCEMD 6/27/96 & 6/28/96.
ST-52	Former UST for Security Police Emergency Generator Facility 10400A	3			NFA; Clean closure letters from SCEMD 6/27/96 & 6/28/96.
ST-53	Former UST for Weapons Storage Area Boiler, Facility 18051	3			NFA; Clean closure letters from SCEMD 6/27/96 & 6/28/96.
SS-54	Sanitary Sewer (SS) Hazardous Waste Accumulation Point at Aerospace Ground Equipment (AGE) Shop, Facility 4348	3		X	In Situ Treatment
SD-55	OWS at Facility 7038	3			NFA

TABLE 1 (continued): IRP Five-Year Review Status					
Site ID	Site Description	OU	Type of Review Statutory Policy		Notes
SD-56	OWS at former Motor Pool Wash Rack, Facility 2989	3			Excavation, then In Situ Treatment. Closed with RAR concurrence in 2002.
SD-57	OWS at Facility 7019	3		X	In Situ Treatment
SD-58	OWS at Army Helicopter Wash Rack, Facility 4771	3			NFA
SD-59	OWS at Air Training Command (ATC) Wash Rack, Facility 4251	3		X	Excavation, then In Situ Treatment
SD-60	OWS at Facility 6900 (north side of Facility 7005)	3			Excavation, then In Situ Treatment. Closed with RAR concurrence in 2002
SD-61	OWS at Facility 6905 (south side of Facility 7005)	3			NFA
OT-62	OWS at Facility 7110 (Jet Engine Test Stand Facility 7099)	3			Excavation of surface and shallow subsurface soil; Closed with RAR concurrence in June 2001
SD-63	OWS & 2 UST at former Auto Hobby Shop, Facility 3320	3			NFA; USTs received SCEMD closure letter 10/8/96.
SD-64	OWS at Fuel Truck Wash Rack, Facility 4120	3			NFA
SD-65	OWS at Facility 6910 (north corner of Facility 7009)	3			Excavation of surface and shallow subsurface soils; Closed with RAR concurrence 9/2000.
SD-66	OWS at Facility 6915 (north corner of Facility 7024)	3			NFA
SD-67	Sanitary Sewer System in the Strategic Air Command (SAC) Area	5			NFA
ST-68	18 UST for SAC Area JP-4 Hydrant System	3		X	In Situ Treatment

TABLE 1 (continued): IRP Five-Year Review Status					
Site ID	Site Description	OU	Type of Review Statutory Policy		Notes
OT-69	Ordnance Burning and Detonation Area	3			Excavation of surface soil and sediments; closed with RAR concurrence 10/2003
ST-70	Former UST at Dining Hall, Facility 1226	3			Referred to as Site A in ROD. Clean closure letter from SCEMD 8/30/94.
ST-71	5 Former UST at Aviation Gasoline (AVGAS) Pumping Station, Facility 3271	3*			Referred to as Site B in ROD *selected for no further action under CERCLA but remains to be closed under other regulations; SVE operating.
ST-72	Former UST at Water Plant, Facility 3975	3			Referred to as Site C in ROD. Clean closure letters from SCEMD 6/27/96 & 6/28/96
ST-73	Former UST for ILS Localizer Emergency Generator Facility 10015	3			Referred to as Site E in ROD. Clean closure letters from SCEMD 6/27/96 & 6/28/96.
ST-74	Former UST for Utility Vault Emergency Generator Facility 10065	3			Referred to as Site F in ROD. Clean closure letters from SCEMD 6/27/96 & 6/28/96.
ST-75	Former UST at Weapons Storage Area, Facility 18018	3			Referred to as Site G in ROD. Clean closure letters from SCEMD 6/27/96 & 6/28/96.
ST-76	Former UST at Weapons Storage Area, Facility 18011 & 18020	3			Referred to as Site H in ROD. Closure letters for 18011 from SCEMD 6/27/96 & 6/28/96. 18020 being biovented.
ST-77	Former UST Army Helicopter Pad, Facility 4853	3			Referred to as Site I in ROD. Clean closure letters from SCEMD 10/8/96.
ST-78	2 UST East of Facility 2527 (2527 & 2527B)	N/A			Clean closure letters from SCEMD 6/17/87, 7/17/97 & 6/15/98. RWQCB concurrence letter for 2527B dated 5/15/98
ST-79	UST East of Facility 4540	N/A			Clean closure letters from SCEMD 6/17/87, & 6/15/98. RWQCB concurrence letter 5/15/98.

TABLE 1 (continued): IRP Five-Year Review Status					
Site ID	Site Description	OU	Type of Review Statutory Policy		Notes
SD-80	Golf Course Maintenance Area Drainage	6			OU6 ROD in preparation; Remedial Action (RA) planned to be complete within 5 years.
ST-81	Sewage Oxidation Ponds	5			NFA
OT-82	Golf Course Maintenance Area (near Facility 8869)	5*			*selected for no further action under CERCLA; closed by RWQCB letter 8/4/99.
SD-83	Army Aviation Helicopter Washrack (Facility 4771)	5*			*selected for no further action under CERCLA but remains to be closed under other regulations
SD-84	Sewer Lines SAC Area to Sewage Treatment Plant	5			NFA
SD-85	South Ditch (N.E. Morrison Creek Tributary from Facility 10030 to 10085)	6			Removal actions 1998 and ; OU6 ROD in preparation.
OT-86	Military Small Ann Firing Range (Facility 12500)	5			Excavation and stabilization of soil; RAR in regulatory review.
OT-87	Rod and Gun Club Skeet and Trap Range (Facility 10330)	5	X		Excavation and stabilization of soil; Closure Report issued 1999.
DD- 88	Drainage Ditch (DD) Morrison Creek from Mather Lake to AC&W Area	6			OU6 ROD in preparation; RA planned to be complete within 5 years.
OT-89	Old Trap Range	6	(Future)		OU6 ROD in preparation; lead will remain on site.
	Main Base/SAC Plume	2		X	Phased RA began in 1998
	Northeast Plume	2	X		Groundwater Monitoring
	Site 7 Plume	2		X	RA began in 1999

*Sites with asterisk have or had only petroleum contaminants and are non-CERCLA sites.

OU = Operable Unit (for other acronyms and initialisms, see pages iv — vi)

OU 1 is the Aircraft Control and Warning OU; OU 2 is the Groundwater OU

OU 3 is the Soils OU; OU 4 is the Landfill OU; OU 5 is the Basewide OU

OU 6 is the Supplemental Basewide OU

2.0 SITE DESCRIPTIONS AND CHRONOLOGIES

This section presents descriptions and histories of all the sites at Mather for which remedial action has been selected in a Record of Decision (ROD) or for which a ROD has not yet been prepared. Each subsection includes the determination of whether a five-year review is required for each site. This section incorporates information about the site chronology for Mather as a whole, followed by information about the remedy implementation for each contaminated site at Mather.

For the sites that do not require a five-year review, more detail is provided in this section about the remedial action selected in the ROD for that site. For those sites requiring a statutory or policy five-year review, more detail regarding the remedial action selected for each site is provided in Section 3, followed by an evaluation of the remedial objectives of the remedial action. This allows uninterrupted flow from description of the remedy to evaluation of remedial objectives for the sites undergoing the five-year review.

2.1 Overview of Mather Air Force Base: Site Description and History

Mather Air Force Base (now closed, and called Mather) is located in the Sacramento Valley, approximately ten miles east of downtown Sacramento, California, just south of U.S. Highway 50. The formerly active base encompassed approximately 5,845 acres at the time of closure (including 129 acres of easements) in an unsurveyed part of Township 8 North, Ranges 6 East and 7 East. Mather was constructed in 1918 and its primary mission was as a flight training school. The base operated continuously as a training base for aviators from 1942 until 1993. The base was decommissioned under the Base Closure and Realignment Act on September 30, 1993. A wing of the Strategic Air Command was located at Mather from the late 1950's until 1989. Fulfilling these missions have involved use and generation of a wide range of toxic and hazardous chemicals and substances, including industrial solvents, aviation fuels, and a variety of oils and lubricants.

The Installation Restoration Program began in 1982 to identify locations at Mather where hazardous substances or other pollutants might have been released to the environment. These previous investigations have confirmed the presence of volatile organic compounds and other hydrocarbons at several of the IRP sites. Based on this, the entire base was proposed for listing on-the Superfund (CERCLA) National Priorities List (NPL) in July 1989, and was placed on the NPL on November 21, 1989. In July 1989, the United States Air Force (USAF), the U.S. EPA, and the State of California signed a Federal Facility Agreement (FFA) (USAF, 1989) under CERCLA Section 120 to ensure that environmental impacts from past and present operations are thoroughly investigated and appropriate cleanup actions are taken to protect human health, welfare, and the environment. The FFA sets enforceable deadlines for documents, defines roles and responsibilities of each signatory party, and provides a vehicle for dispute resolution. The USAF is the owner of site, the principal responsible party, and lead agency for

conducting investigative and cleanup activities. There have been no CERCLA enforcement actions related to any of the sites at Mather, including the Groundwater OU plumes.

There are now 89 IRP sites at Mather, the locations of which are shown in Figure 1. There are also four major groundwater plume areas, shown on Figure 2. The 89 IRP sites have been categorized in six operable units (OUs), based upon similarities in type of site and/or timing of cleanup decisions. The AC&W OU consists of a groundwater contamination plume as well as three sites where underground fuel storage tanks were removed. The Landfill OU consists of 6 sites where municipal waste was buried. The Soil OU is comprised of contaminated soils associated with waste disposal pits, oil/water separators (OWS), gas stations, underground storage tanks (USTs), fire training areas, and other miscellaneous sites. The Groundwater OU consists of contaminated groundwater plumes with sources at Mather, which lie beneath and downgradient of Mather, with the exception of the AC&W OU Plume. The Basewide OU and the Supplemental Basewide OU consist of the remaining sites identified at Mather.

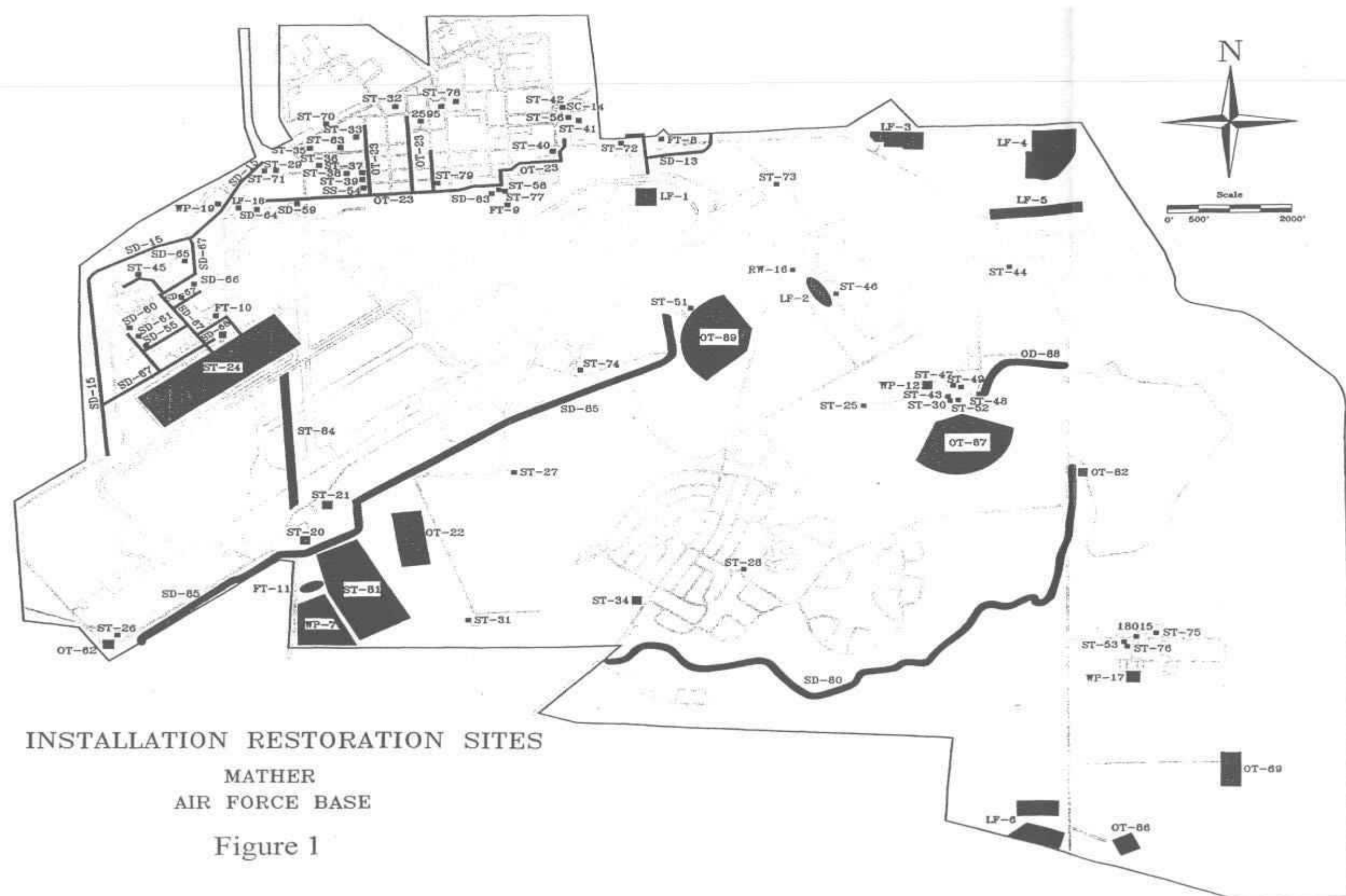
2.2 Aircraft Control & Warning Operable Unit History and Contamination Summary

The Aircraft Control and Warning (AC&W) Site is the location of a radar station now operated by the Federal Aviation Administration (FAA) but formerly operated jointly by the FAA and the Air Force. The AC&W Site is Installation Restoration Program (IRP) Site WP-12. Site WP-12 and three nearby sites where underground storage tanks were removed, IRP sites ST-25, ST-30, and ST-47, make up the AC&W Operable Unit. The location of the AC&W Site is shown on Figure 1. The outline of the AC&W plume appears on Figure 2, and a more detailed map of the plume appears as Figure 3..

The water supply well serving the AC&W area was sampled by the Air Force in 1979 and found to be contaminated with trichloroethene (TCE). Follow-on investigations in the 1980's revealed a TCE plume extending from the vicinity of the radar site about a mile southeast to the family housing area, predominantly in the upper 60 feet of the aquifer. The maximum concentrations of TCE were about 1 milligram per liter (mg/l).

Table 2 presents a summary of previous investigations, reports of which contain detailed information about the AC&W groundwater contamination plume.

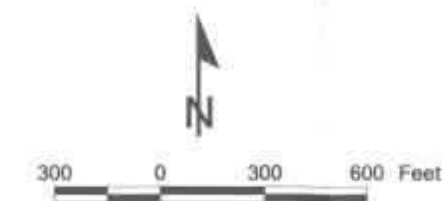
The AC&W Record of Decision was signed in December 1993 (AFBCA, 1993), and a pump-and-treat remedial action began operating in January 1995. The system was designed to operate at 270 gallons per minute (gpm) but only 45 – 65% of this capacity was initially used because the reinjection system could not accommodate the design flow. In June 1997, the treated water was diverted from the injection system to surface water discharge at Mather Lake, in accordance with an Explanation of Significant Difference (AFBCA, 1997a) authorizing and documenting this change. Since then the system has



INSTALLATION RESTORATION SITES

MATHER
AIR FORCE BASE

Figure 1

 INFERRED GROUNDWATER FLOW DIRECTION

INTERPRETED DOWNGRADE EXTENT OF CAPTURE

WATER TABLE: TCE ISOCONCENTRATION
CONTOURS (ug/L) BASED ON REPORTED
AND HISTORICAL SAMPLE CONCENTRATIONS
FROM SHALLOW WATER BEARING ZONE WELLS
(DASHED WHERE INFERRED OR UNCERTAIN)

DEEPER UNIT C: TCE ISOCONCENTRATION
CONTOURS (ug/L) BASED ON REPORTED
AND HISTORICAL SAMPLE CONCENTRATIONS
FROM DEEPER UNIT C WELLS
(DASHED WHERE INFERRED OR UNCERTAIN)

UNIT C GROUNDWATER POTENTIOMETRIC
SURFACE ELEVATION CONTOURS (FT. MSL)
FOURTH QUARTER 2003

Monitoring Well	Hydro_Unit	Date Sampled	TCE (ug/L)
MAFB-050	WT/C	2Q03	1.7
MAFB-051	WT/C	4Q94	<0.5
MAFB-052	WT/Q	2Q03	<0.5
MAFB-054	WT/C	4Q94	<1.0
MAFB-077	WT/C	2Q03	<0.5
MAFB-079	WT/C	4Q94	<1.0
MAFB-083	WT/Q	2Q01	5.8
MAFB-084	WT/C	2Q97	<0.5
MAFB-190	WT/C	2Q03	0.91
MAFB-192	WT/C	2Q98	<0.5
MAFB-197	WT/C	2Q03	<0.5
MAFB-401	WT/C	4Q03	5.7
MAFB-402	WT/C	4Q03	5.4
MAFB-403	WT/C	4Q03	4.2
MAFB-408	WT/C	4Q03	0.82
ACW PZ-06	WT/C	3Q02	<0.5
ACW PZ-07	WT/C	3Q02	8.3
ACW PZ-08	WT/C	3Q02	6.4
ACW PZ-09	WT/C	4Q03	18
ACW PZ-10	WT/C	4Q03	30
ACW AT-1	C	4Q03	24
ACW AT-2	C	4Q03	29
ACW EW-1	C	4Q03	14
ACW EW-2	C	4Q03	16
ACW EW-3	C	4Q03	21
ACW EW-4	C	4Q03	15
ACW EW-5	C	4Q03	<0.5
ACW EW-6R	C	4Q03	27
MAFB-053	C	4Q03	1.3
MAFB-193	C	2Q03	<0.5
MAFB-194	C	4Q03	26
MAFB-195	C	2Q03	<0.5
MAFB-196	C	4Q03	8.1
MAFB-198	C	2Q03	<0.5
MAFB-301	C	4Q03	41
MAFB-302	C	4Q03	<0.5
MAFB-303	C	2Q03	<0.5
MAFB-304	C	4Q03	<0.5
MAFB-305	C	2Q03	<0.5
MAFB-306	C	4Q03	7.3
ACW PZ-01	C	2Q03	<0.5
ACW PZ-02	C	4Q03	<0.5
ACW PZ-03	C	2Q03	<0.5
ACW PZ-04	C	2Q03	<0.5
ACW PZ-05	C	4Q03	0.93
ACW PZ-06C	C	2Q03	8.9
ACW PZ-07C	C	2Q03	3.4
ACW PZ-08C	C	2Q03	2.5
ACW PZ-09C	C	3Q02	1.3
ACW PZ-10C	C	2Q03	<0.5
MAFB-068	D	4Q94	<1.0
MAFB-069	D	4Q94	<1.0
MAFB-070	D	4Q94	<1.0
MAFB-071	D	4Q94	<1.0
MAFB-072	D	4Q94	<1.0
MAFB-078	D	2Q03	<0.5
MAFB-080	D	4Q94	<1.0
MAFB-191	D	2Q03	<0.5

HYDROGEOLOGICAL UNIT COLOR CODE

- ④ WATER TABLE (WT/C)
- ④ UNIT C (deeper portion of Unit C)
- ④ UNIT D
- ④ GROUNDWATER MONITORING WELL
- ④ GROUNDWATER PIEZOMETER
- ④ GROUNDWATER EXTRACTION WELL
- ④ GROUNDWATER INJECTION WELL
- ▲ GROUNDWATER PRODUCTION WELL (DRINKING WATER SUPPLY)



FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

**TCE ISOCONCENTRATION CONTOURS
FOR THE AC&W PLUME
FOURTH QUARTER 2003**

FIGURE 3

been operating in the range of 170 to 270 gpm (about 180 gpm in 2003). The influent concentration has dropped from about 130 micrograms per liter (ug/l) during 1995 to about 60 ug/l during 1998, to about 20 ug/L in 2003.

Table 2. Previous Investigations of the AC&W Groundwater Plume

Previous Investigations, AC&W Groundwater Plume	Report Reference
Installation Restoration Program (IRP) Phase II, Stage 1 Investigation	Roy F. Weston, 1986
IRP Phase II, Stage 3 Investigation	AeroVironment, 1988
Well Redevelopment and Sampling	IT Corp., 1990a
Quarterly Routine Groundwater Sampling	EA Engineering, 1990a, 1990b, 1991
Site Inspection Report	IT Corp., 1990b
Preliminary Design Investigation	IT Corp., 1992b
Quarterly Groundwater Monitoring	IT Corp, 1991a, b; 1992a, c, d, e; 1993a, d, e, h; 1994a, b, c, e; 1995a, c, d, e; 1996a
(Quarterly) Basewide Groundwater Monitoring	Montgomery Watson, 1996a, b, c; 1997a, c, d, f, j; 1998a,c,f,h, m, 1999k, s, t, v; 2000j, p, r, t; 2001 e, f, h, k; MWH 2002a, f, g, h; 2003d, e, h

The Air Force issued a report of proper and successful operation for the AC&W remedial action in September 1998 (AFBCA, 1998d), and received U.S. EPA concurrence in November 1998 (U.S. EPA, 1998). The remedial action will take more than five years to attain the cleanup standards. Therefore a five-year policy review is appropriate.

2.3 Groundwater Operable Unit History and Contamination Summary

The Groundwater Operable Unit (OU) consists of all groundwater contamination at and originating from Mather with the exception of the AC&W OU Plume, which is addressed in a separate ROD (AFBCA, 1993). The Groundwater OU has been subdivided into the Site WP-07 Plume, which appears to emanate from a source or historic source at the IRP Site WP-07 waste pit; the Northeast Plume, with apparent source(s) at the IRP Site LF-04 landfill and the IRP Site LF-03 landfill; the Main Base Plume, with its primary source at Site OT-23 in the Main Base area; and the Strategic Air Command (SAC) Industrial Area Plume, with its principal source evident in the vicinity of IRP Site SD-57. The ROD combined the Main Base and SAC Industrial Area plumes for purposes of selecting the

remedial alternative. Figure 2 shows the outline of the Groundwater OU Plumes as well as the AC&W Plume.

Contamination exists at the Groundwater OU plumes as a result of past military operations conducted between 1918 and 1993. The main sources of contamination include dry cleaning (IRP Site OT-23), industrial activities, equipment maintenance, landfill disposal (Northeast Plume), other waste disposal activities (i.e., Site WP-07), and fuels storage and delivery. Known vadose-zone sources are addressed as part of the Soil OU or the Basewide OU.

Table 3 presents a summary of previous investigations, for which the referenced reports contain detailed information about each plume of groundwater contamination. In addition to these investigations, more data has been obtained during the remedial actions at each of the plumes.

Table 3. Previous Investigations at the Groundwater Operable Unit Sites

Groundwater Plume	Applicable Investigation
Main Base/Strategic Air Command Industrial Area	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
Site 7	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Northeast	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

1. Installation Restoration Program (IRP) Phase II, Stage 1 Investigation [Roy F. Weston Inc. 1986];
2. IRP Phase II, Stage 2 Investigation [AeroVironment 1987];
3. IRP Phase II, Stage 3 Investigation [AeroVironment 1988];
4. Sampling and Analysis Report for Site Monitoring Wells, October/November 1988 [IT Corp. 1990a];
5. Site Inspection Report [IT Corp. 1990b];
6. Quarterly Routine Groundwater Sampling, 1990 [EA 1990a, 1990b, 1991];
7. Quarterly Routine Groundwater Sampling, 1991 - 1995 [IT Corp. 1991a, b; 1992a, c, d, e; 1993a, d, e, h, 1994a, b, c, e; 1995a, c, d, e; 1996a];
8. Group 2 Sites Remedial Investigation Report [IT Corp. 1993c];
9. Group 3 Sites Technical Memorandum [IT Corp. 1993f];
10. Soil Operable Unit (OU) and Groundwater OU Additional Field Investigation Report [IT Corp. 1994d];
11. Mather Baseline Risk Assessment Report [IT Corp. 1995f];
12. Groundwater OU and Soil OU Focused Feasibility Study Report [IT Corp. 1995b];
13. Routine (Quarterly) Groundwater Sampling, 1996 - 1998 [Montgomery Watson, 1996a, b,c; 1997a, c, d, f, j; 1998a, c, f, h, m, 1999k, s, t, v; 2000j, p, r, t; 2001e, f, h, k; MWH 2002a, f, g, h; 2003d, e, h];
14. Additional Site Characterization Report [IT Corp., 1996b]; and
15. Deep Aquifer Characterization Report [Montgomery Watson, 1998d]

2.3.1

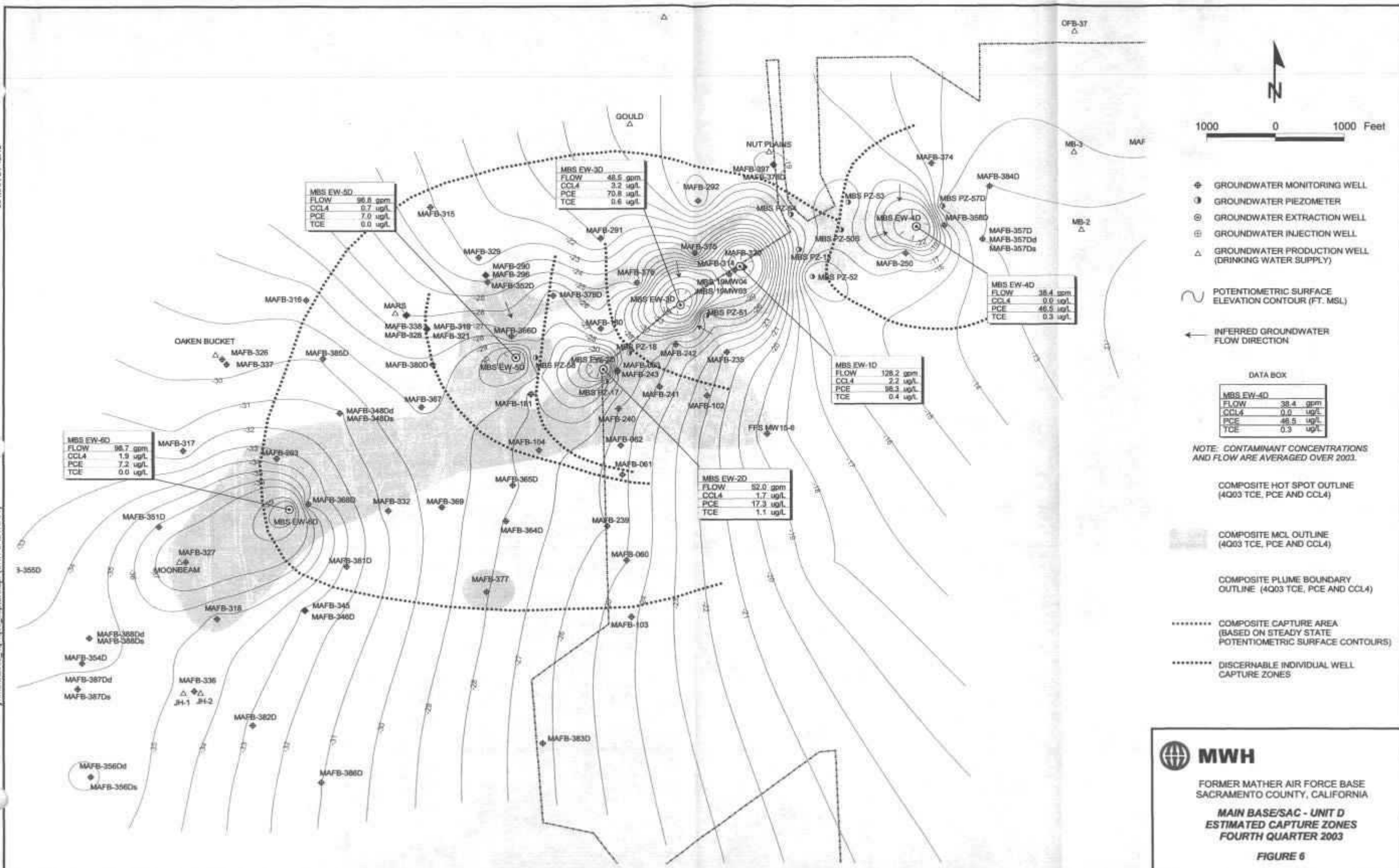
Main Base/ SAC Area Plume

The Main Base/ SAC Area Plume is actually made up from several plumes, consisting of groundwater contamination from several sources that has commingled in portions of the aquifer. The combined plume extends from its upgradient extent near Site SD-56, across the portion of Mather north of the runways, and more than a mile beyond Mather to the west, crossing westward beneath Bradshaw Road between Old Placerville Road and Kiefer Boulevard. Contaminants from this plume were first detected in private wells sampled by the Central Valley Regional Water Quality Control Board (CVRWQCB) between 1979 and 1987. Between 1984 and the present, the Air Force has installed over 500 groundwater monitoring wells that are included in a routine sampling program and/or performance monitoring program with quarterly reporting. The locations of these wells are shown in Figure 2. Figures 4, 5, and 6 show the plume in progressively deeper aquifer horizons, called the water table; Unit B upper (Bu) and B; and Unit D.

The contaminants of concern identified in the ROD for the Main Base/ SAC plume are perchloroethene (PCE); TCE; 1,1-dichloroethene (DCE); cis-1,2-DCE; 1,2-dichloroethane (DCA); carbon tetrachloride; total petroleum hydrocarbons reported as diesel (TPH-d); total petroleum hydrocarbons reported as gasoline (TPH-g); benzene; xylenes; chloromethane; and lead. The cleanup standards established in the Groundwater OU ROD are presented in Table 5.

The Groundwater OU ROD selected a remedial action that uses pump-and-treat technology, with removal of volatile contaminants by air stripping, and reinjection (possibly in combination with other compatible discharge options) of the treated water into the aquifer. The ROD also calls for a phased implementation of the remedial action for the Main Base/SAC Area Plume. Phase I addressed 'hot spots' of groundwater contamination on-base, and began operation in April 1998, extracting groundwater at about 700 gallons per minute (gpm). Phase II extraction wells, addressing off-base 'hot spots', and Phase III extraction wells, augmenting Phase I capture, were added in January 2000, increasing system flow to about 900 gpm. Phase IV wells, expanding capture off-base and further augmenting extraction on Mather, began operating in September 2002, boosting the treatment rate to about 1600 gpm. A performance evaluation of the extraction system and initial design of Phase V system build-out has been planned for 2004, and construction of Phase V is planned for 2005, but as this five-year review is conducted, revised plans are being implemented to install an additional extraction well near the western boundaries of the plume in 2004, and conduct the in-depth performance evaluation in 2005.

The remedial action will take more than five years to attain the cleanup standards. Therefore a five-year policy review is appropriate.



2.3.2 Site WP-07 Plume

The Site WP-07 Plume extends about a mile off base to the southwest from IRP Site WP-07 (Figure 2). Groundwater contamination has consisted of TCE up to 180 ug/l, PCE up to about 35 ug/l, and lesser amounts of other chlorinated ethenes, ethanes and benzenes. Vinyl chloride concentrations were detected in well MAFB-41 starting abruptly in July 1996, were as high as 19 ug/l, but have declined to levels less than 2 ug/l during 2003. Sampling since 1998 has detected generally lower concentrations of contaminants than in the past.

The contaminants of concern (COCs) in groundwater at Site WP-07 identified in the Superfund Record of Decision, Soil Operable Unit Sites and Groundwater Operable Unit Plumes (AFBCA, 1996b) are PCE; TCE; 1,1-DCE; 1,2-DCA; vinyl chloride; total petroleum hydrocarbons reported as diesel (TPH-d); benzene; 1,4-dichlorobenzene; and chloromethane. Cleanup standards established in the ROD are presented in Table 5.

Remediation of the Site WP-07 Plume began in December 1998, using a single extraction well. Additional piezometers were installed in January 1999 to improve plume definition and contribute to the information to be used in selecting additional extraction well locations and monitoring the aquifer response to the extraction wells. The extraction has been interrupted a total of three times by aggregate mining activities; the system is scheduled to resume operation in 2004.

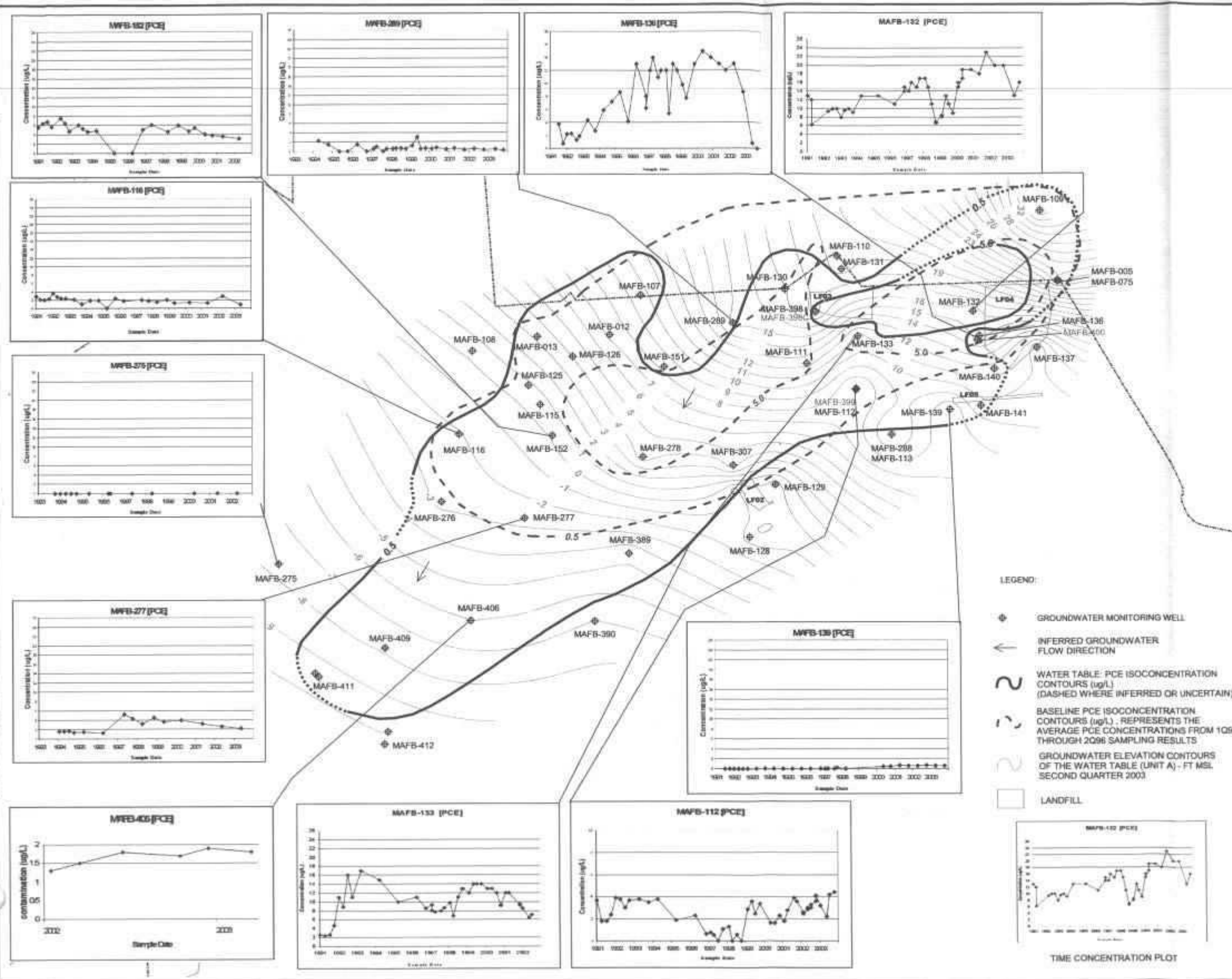
The remedial action will take more than five years to attain the cleanup standards. Therefore a five-year policy review is appropriate.

2.3.3 Northeast Plume

The Northeast Plume consists of a portion of groundwater contamination emanating from one or more source areas for PCE and DCE in the vicinity of the IRP Site LF-03 and Site LF-04 landfills, and a source of 1,2-dichloropropane (DCP) at or near the former location of the IRP Site 5 landfill (see figures 7 and 8). The Northeast Plume extends to the west-southwest, beneath the airport and south of the Main Base Plume. The COCs identified in the ROD for the Northeast Plume are PCE; 1,2-DCE; carbon tetrachloride; chloromethane; and 1,2-DCP. However, only PCE and 1,2-DCE have been detected above their respective cleanup standards since the ROD was issued in 1996 (AFBCA 1996b). The maximum concentrations detected in the Northeast Plume since the ROD was issued are 23 ug/l PCE and 23 ug/l 1,2-DCE. The cleanup standards for these COCs are 5 ug/l and 6 ug/l, respectively. Although TCE is not a COC for the Northeast Plume, it continues to be monitored and has been detected in several wells, but never above the cleanup standard established for remedial action of the other plumes. Cleanup standards for all COCs established in the ROD are presented in Table 5.

13 MAR 04 17:00

Y:\mafbi2003_4q4q03.spr (NE PCE)



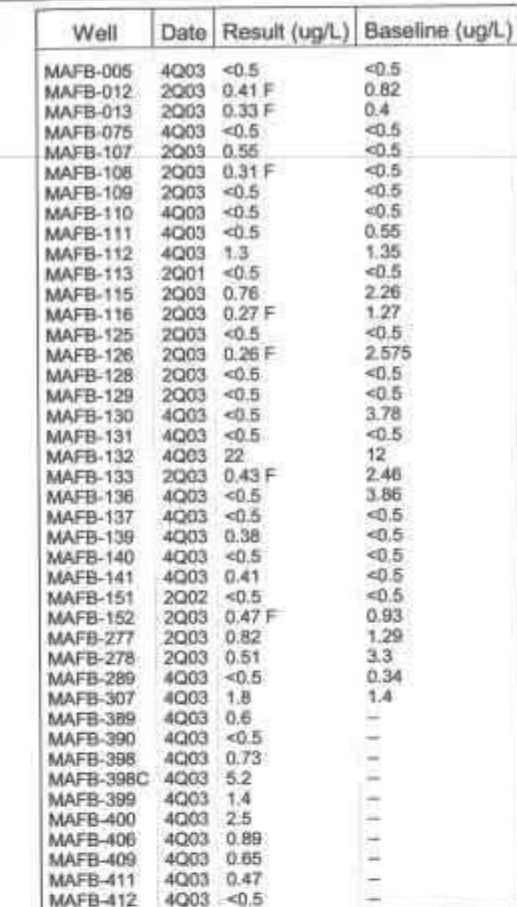
Well	Date	Result PCE	Baseline PCE
MAFB-005	4Q03	0.59	0.6
MAFB-012	2Q03	1.3	2.6
MAFB-013	2Q03	0.72	0.9
MAFB-075	4Q03	0.33	<1.0
MAFB-107	2Q03	1.6	1.4
MAFB-108	2Q03	<0.5	<1.0
MAFB-109	2Q03	2.3	2
MAFB-110	4Q03	0.32	1
MAFB-111	4Q03	1.7	5.3
MAFB-112	4Q03	4.4	2.7
MAFB-113	2Q01	<0.5	<1.0
MAFB-115	2Q03	2.4	3.7
MAFB-116	2Q03	0.91	1.7
MAFB-125	2Q03	0.79	0.9
MAFB-126	2Q03	1.7	5.2
MAFB-128	2Q03	<0.5	<1.0
MAFB-129	2Q03	<0.5	<1.0
MAFB-130	4Q03	1.7	7.2
MAFB-131	4Q03	<0.5	0.6
MAFB-132	4Q03	16	12.3
MAFB-133	2Q03	3.2	12
MAFB-136	4Q03	<0.50	7.8
MAFB-137	4Q03	0.25	<1.0
MAFB-139	4Q03	0.6	<1.0
MAFB-140	4Q03	0.62	<1.0
MAFB-141	4Q03	0.63	<1.0
MAFB-151	2Q02	0.32	<1.0
MAFB-152	2Q03	1.2	1.9
MAFB-277	2Q03	2.2	1.5
MAFB-278	2Q03	3.2	7.8
MAFB-289	4Q03	0.28	1.3
MAFB-307	4Q03	2.4	3.4
MAFB-389	4Q03	2.3	—
MAFB-390	4Q03	<0.5	—
MAFB-398	4Q03	5.3	—
MAFB-398C	4Q03	3.4	—
MAFB-399	4Q03	1	—
MAFB-400	4Q03	2	—
MAFB-406	4Q03	1.8	—
MAFB-409	4Q03	0.98	—
MAFB-411	4Q03	0.96	—
MAFB-412	4Q03	0.32	—

All results in ug/L



Note: Wells MAFB-398C, -399, and -400 are screened in the deeper portion of Unit C and are not used to evaluate isoconcentration contours.

MWH
 FORMER MATHER AIR FORCE BASE
 SACRAMENTO COUNTY, CALIFORNIA
**CONCENTRATIONS OF PCE
 IN THE WATER TABLE
 NORTHEAST PLUME
 FOURTH QUARTER 2003**
FIGURE 7



Note: Wells MAFB-398C, -399, and -400 are screened in the deeper portion of Unit C and are not used to evaluate isoconcentration contours.

**MWH**

FORMER MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA

CONCENTRATIONS OF *cis*-1,2-DCE
IN THE WATER TABLE
NORTHEAST PLUME
FOURTH QUARTER 2003

FIGURE 8

The remedial action selected for the Northeast Plume is described in Section 3.2.4.1, and consists of long-term groundwater monitoring. The remedy calls for reconsideration of active remediation if monitoring or modeling indicates that the contaminants will not meet cleanup standards within a reasonable time, or within 40 years of the ROD, or indicates that significant migration of the contaminants will occur at concentrations above the cleanup standards that will impact public health or the environment.

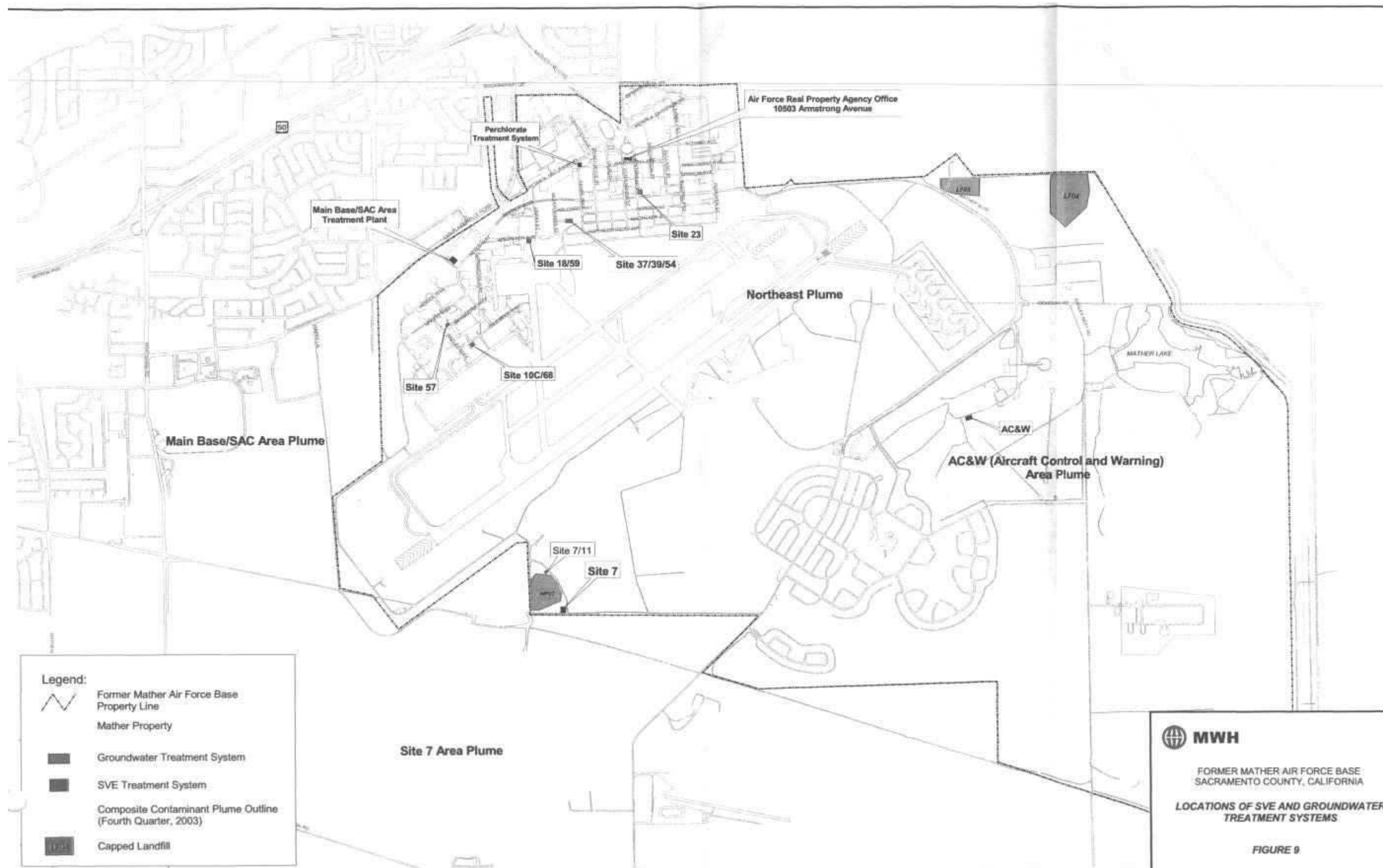
The presumed primary source areas for the plume, landfill sites LF-03 and LF-04, have been closed with engineered caps to prevent percolation of rainwater through the buried refuse. The Northeast Plume is being monitored to observe whether the landfill closures will succeed in mitigating the concentrations of contaminants entering the groundwater from any residual source(s) within the landfills, and to observe dispersion of the plume. The remedial action will take more than five years to attain the cleanup standards, so a five-year policy review is appropriate.

2.4 Soils Operable Unit History and Contamination Summary

Fourteen IRP sites in the Soils Operable Unit were selected for remediation in the Record of Decision for the Soils Operable Unit Sites and Groundwater Operable Unit Plumes. Of these, eight sites are undergoing remedial action that may require at least five years to complete, and therefore require five-year policy review. A brief history of each of the Soil Operable Unit sites follows; only those requiring a policy review are evaluated further in this report. Some sites are grouped together because of a common remedial action.

2.4.1 IRP Site WP-07 and Site FT-11

Site WP-07 (7100 Area Disposal Site) and Site FT-11 (Existing Fire Training Area) have been combined for the purpose of implementing in situ treatment to remediate total petroleum hydrocarbons reported as diesel (TPH-d). The location of these sites in relation to the groundwater plumes is shown in Figure 9. Site WP-07 was a gravel pit used for disposal of construction rubble as well as petroleum, oil, and lubricant (POL) wastes during the time period from 1953 to 1966. Site WP-07 is the apparent source area for the Site WP-07 groundwater contaminant plume that extends off base to the south-southwest. The Air Force decided to use Site WP-07 to dispose of soil excavated from other IRP sites, and treated as necessary to meet municipal landfill acceptance criteria. This helped to fill in the former pit, and create a mound to shed rainwater. The site was capped in accordance with landfill closure regulations, using an impermeable liner material sandwiched between protective geotextile fabric, overlain by two feet of root zone soil that supports a vegetation layer. Site FT-11 is adjacent to the north of Site WP-07, and was the location of a fire training area where waste fuels were burned as a part of training exercises. A newer, lined and monitored fire training pit was built in the same



general area. The COCs identified in the ROD are TPH-d, and TPH-g. The cleanup standards established in the ROD are presented in Table 5.

The remediation strategy selected in the ROD and employed by the Air Force has included operating a soil vapor extraction (SVE) system to remove the more volatile fuel constituents from the vadose zone, and evaluating the extracted vapor for chlorinated solvents in case there is residual contamination that may still be contributing to the groundwater contamination plume. The landfill cap covers the area containing buried solid waste.

An SVE system was installed and began operation for Site FT-11 in November 1998, and a separate SVE system began operation at Site WP-07 in December 1998. These extraction systems were later combined and operated with a single treatment unit. Each of the treatment systems used thermal destruction of contaminants. The systems used heat exchangers to reduce consumption of propane. In addition the initial system at Site WP-07 used a catalytic oxidation mode. In addition, groundwater extraction and treatment began for the Site WP-07 Plume in December 1998. The in situ remediation systems for sites WP-07 and FT-11 are described in the Informal Technical Information Report for Site 7/11 (Montgomery Watson, 1999m). The Operation and Maintenance Manual for Sites 7/11, Soil Vapor Extraction and Biovent Systems Manufacturer's Literature, was issued in March 1999 (Montgomery Watson, 1999f).

The remedial action may take more than five years to attain the cleanup standards. In fact, the post-closure period for the landfill at Site WP-07 is a minimum of 30 years. Land-use restrictions are required for the landfill area to protect the cap and prevent exposure to the buried waste. Therefore a statutory five-year review is required.

2.4.2 IRP Site SD-13

Site SD-13, Drainage Ditch No. 1, also includes the site of an oil-water separator associated with an aircraft wash rack, and a depression investigated for soil contamination. The Site SD-13 ditch received storm-water runoff from off base, and may have also received overflow from the oil-water separator (OWS). COCs were identified in the ROD for surface water, sediment, and soils. The COCs identified in surface water were all metals. The COCs identified in the ROD for sediment are metals and pesticides. The COCs identified in the ROD for surface soils are metals, petroleum products, and polycyclic aromatic hydrocarbons (PAHs, also known as polynuclear aromatic hydrocarbons, or PNAs). The cleanup standards established in the ROD are presented in Table 5.

The remedial action for Site SD-13 included these major components:

- Removing surface water, if present, by pumping and discharging to the publicly owned treatment works (POTW);
- Excavating approximately 1,900 cubic yards (yd³) of contaminated sediments and surface soils to remove all contamination above acceptable levels;

- Transporting the excavated soils to the on-base ex situ bioremediation facility;
- Treating the excavated soils by ex situ bioremediation as appropriate;
- Transporting the treated soils to, and consolidating them with landfill cap foundation materials at Site WP-07, as appropriate; and
- Monitoring the groundwater if contamination that threatens groundwater quality remains at the site, and monitoring surface water if contamination that threatens surface water quality remains at the site.

The contaminated sediment and surface soil at Site 13 were successfully excavated in 1997, and the remedial action was documented in the Site 13 Closure Report, dated July 1998 (Montgomery Watson 1998e). No surface water was present during the remediation, and the remedial project managers for the Air Force, U.S. EPA, and the State of California agreed that once cleanup of the sediment in the ditch occurred, future surface water would not be contaminated by environmental contamination at this site. The closure report concluded that the remedial action achieved the site cleanup standards established in the ROD, to allow clean closure of the site. The Remedial Action Report was issued in September 2000 (AFBCA, 2000c), and received U.S. EPA concurrence on September 27, 2000 (U.S. EPA, 2000c). Therefore, no five-year review is required for Site 13.

2.4.3 IRP Site SD-15

Site SD-15, Drainage Ditch No. 3, also known as the West Ditch, drains the former Strategic Air Command portion of Mather. Prior to the 1970's, it received some discharge of industrial waste; these discharge lines were later connected to the sanitary sewer system.

COCs were identified in the ROD for surface water and sediment at Site SD-15. The COCs identified in surface water were all metals. The COCs identified in the ROD for sediment are metals, pesticides, petroleum products, and PAHs. The cleanup standards established in the ROD are presented in Table 5.

The remedial action for Site SD-15 included these major components:

- Removing surface water, if present, by pumping and discharging to the POTW;
- Excavating approximately 4,300 yd³ of contaminated sediments to remove all contamination above acceptable levels;
- Transporting the sediments to the on-base ex situ bioremediation facility;

- Treating the excavated sediments by ex situ bioremediation as appropriate;
- Transporting the treated sediments to, and consolidating them with landfill cap foundation materials at Site WP-07, as appropriate; and
- Monitoring the surface water if contamination that threatens surface water quality remains at the site.

Site SD-15 remediation began in 1997, was suspended during the wet winter months, and was completed in 1998. The remedial action is documented in the Informal Technical Information Report for Remedial Action at Sites 15, 20, 85, 86, and 87 (Montgomery Watson, 1999s). No residual contamination was identified at the site at the completion of the remedial action. The Remedial Action Report was issued in July 2001 (AFBCA, 2001e), and received U.S. EPA concurrence on September 10, 2001 (U.S. EPA, 2001d). Therefore, no five-year review will be required for Site SD-15.

2.4.4 IRP Site ST-20

Site ST-20 is the former wastewater treatment plant, which includes the site of a former motor gasoline underground storage tank (UST), sludge drying beds and surrounding soil where sewage sludge may have been spilled. Contaminants of concern for the sludge drying beds were established in the ROD for the Soils Operable Unit. Contaminants of concern (COC's) were established for additional soil areas at Site ST-20 in the ROD for the Basewide Operable Unit. The cleanup standards for all COCs established in the RODs are presented in Table 5.

The remedial action selected for Site ST-20 in the Soils OU ROD included the following major components. Please note that additional remedial action for Site ST-20 was incorporated into the Basewide OU.

- Excavating approximately 550 yd³ of TPH-contaminated shallow soils to remove all contamination above acceptable levels;
- Transporting the excavated soils to the on-base ex situ bioremediation facility;
- Treating the excavated soils by ex situ bioremediation as appropriate;
- Transporting the treated soils to, and consolidating them with landfill cap foundation materials at Site WP-07, as appropriate;
- Removing sludge and disposing as appropriate in accordance with 1994 Removal Action Memorandum (RAM) for Site 20 (i.e. either disposal as hazardous waste, or treatment to render it non-hazardous and non-designated for on-base disposal); and

- Monitoring the groundwater if contamination that threatens groundwater quality remains at the site.

The remedial action selected for Site ST-20 under the Basewide OU included these additional components:

- Excavating and transporting approximately 500 cubic yards of contaminated surface soils to the Mather Soil Bioremediation Facility.
- Ex situ bioremediation of excavated surface soils if necessary until Site 7 acceptance criteria for PAHs are achieved. Compliance with the acceptance criteria will be verified with post treatment confirmation soil sampling and analysis.
- Transporting the treated Site ST-20 soils from the Mather Soil Bioremediation Facility to Site 7 for use as foundation material in construction of a cap if the soils meet Site 7 acceptance criteria or to an appropriate off-base disposal facility.
- Installing one additional groundwater monitoring well at the site. Compliance with cleanup standards will be verified with groundwater monitoring.
- Groundwater monitoring for phthalates and diesel would be conducted for four quarters. If non-detect, monitoring would be discontinued.

A closure report was issued for the initial cleanup of contamination at Site ST-20 that was identified in the Soils Operable Unit (Montgomery Watson, 1997g). The remedial action identified in the Basewide Operable Unit ROD was completed in 1998, and documented in the Informal Technical Information Report for Remedial Action at Sites 15, 20, 85, 86, and 87 (Montgomery Watson, 1999s). U.S. EPA concurrence for the closure of Site 20 will be solicited with the issuance of a Remedial Action Report (RAR), yet to be prepared. No residual contamination judged to threaten human health, ecologic receptors, or water quality was identified at the site at the completion of the remedial action, and groundwater monitoring for one year was conducted to confirm this for phthalates and diesel. Site closure is expected to be the accepted recommendation for the site once the RAR is finalized. However, based upon U.S. EPA acceptance of the Informal Technical Information Report (ITIR), it is judged that no five-year review is required for Site ST-20.

2.4.5 IRP Sites ST-37, ST-39, and SS-54

Sites ST-37, ST-39, and SS-54 have been combined for the purpose of implementing in situ treatment to remediate petroleum constituents. The location of these sites in relation to the groundwater plumes is shown in Figure 9. Site ST-37 is a site where 5 USTs were removed. Site ST-39 was the former hazardous waste storage yard, and prior to that a

storage and distribution point for aviation gasoline. Site ST-39 also contained pipelines and fuel filter sumps. Eight USTs were removed from Site ST-39. Site SS-54 was the Aerospace Ground Equipment (AGE) Repair Shop and contained a hazardous waste accumulation point. The COCs identified in the ROD are fuel components and oil and grease. The cleanup levels established in the ROD are presented in Table 5.

A soil vapor extraction system was constructed in summer 1998, and after a period of start-up and troubleshooting, became operational in December 1998. At the time of this review, the treatment unit at Site ST-37/ST-39/SS-54 also was connected to and treated vapors from the extraction systems at Site ST-29/ST-71 and Site ST-35/ST-36. The Operations and Maintenance Manual was issued in February 1999 (Montgomery Watson, 1999b).

The remedial action may take more than five years to attain the cleanup standards. Therefore a five-year policy review is appropriate.

2.4.6 IRP Site SD-56

Site SD-56 was the site of an oil-water separator (OWS) at the Old Motor Pool Washrack, Facility 2989. The COCs identified in the ROD for the Soils Operable Unit are metals, PAHs, and petroleum constituents. The OWS and surrounding soil were excavated according to the remedial action selected in the ROD, but some contamination remained. As a result, additional remediation by in situ methods was chosen by the Air Force to address the residual contamination, and documented in an Explanation of Significant Difference (AFBCA, 1998e). The cleanup standards established in the ROD are presented in Table 5.

The excavation remedy was documented in the Closure Report for Soil Operable Unit Site 65 and Remedial Action Characterization Report for Soil Operable Unit Sites 56, 59, 60, and 62 (Montgomery Watson, 1997b). The additional in situ treatment remedy is described in the Informal Technical Information Report for Remedial Action at Sites 56 and 60 (Montgomery Watson, 1999g) and the Operations and Maintenance Manual and Manufacturers Literature for Soil Vapor Extraction/ Bioventing Systems at Sites 56 and 60 (Montgomery Watson, 1998p).

The remedial action was completed and documented in the Final Remedial Action Report (Montgomery Watson, 2002a), which obtained U.S. EPA and State concurrence 2002 (U.S. EPA, 2002b; DTSC, 2002b). Therefore a five-year review is not required for Site SD-56.

2.4.7 IRP Site SD-57

Site SD-57 was the AGE Washrack oil-water separator, Facility 7019. The COC identified in the ROD is trichloroethene (TCE). The location of this site in relation to the

groundwater plumes is shown in Figure 9. A soil gas plume of TCE extends from this apparent source area to the southwest, overlying the heart of the TCE groundwater plume at the water table. A soil vapor extraction system began operating at Site SD-57 in October 1997. The initial TCE extraction rate was about 20 – 30 pounds per day for the first 75 days of operation, over about six months. Over the first year, the extraction rate tailed off to about 2 pounds per day, and in the first half of 2003, ranged from 0.14 to 0.55 pounds per day. In 2001, dual-phase extraction was initiated in water table groundwater extraction wells that not only removed vapor but also increased the groundwater extraction rate for the wells. As of June 2003, an estimated 5586 pounds of volatile contaminants had been extracted, about 1956 pounds of which were TCE. The total mass of contaminants removed has roughly doubled since the previous five-year review, but the mass of TCE removed has increased less than 10 percent.

The latest information for the remedial action at Site SD-57 is found in the Informal Technical Information Report for Phase I and Phase II Remedial Action at Site 57 (Montgomery Watson, 1998k) and the Soil Vapor Extraction/Bioventing Semiannual Monitoring Report (MWH, 2003). The Operations and Maintenance Manual for the Site 57 Soil Vapor Extraction System was issued in 1997 (Montgomery Watson, 1997h).

The remedial action is expected to be completed and Site SD-57 closed within five years. However, a policy review is appropriate to maintain continuity from the previous review.

2.4.8 IRP Site SD-59

Site SD-59 was the ATC Washrack oil-water separator (OWS), Facility 4251. The location of this site in relation to the groundwater plumes is shown in Figure 9. The COCs identified in the ROD are total petroleum hydrocarbons reported as diesel (TPH-d) and as gasoline (TPH-g). The cleanup standards established in the ROD are presented in Table 5.

The OWS and surrounding soil were excavated according to the remedial action selected in the ROD, but some contamination remained. As a result, additional remediation by in situ methods was chosen by the Air Force to address the residual contamination, and documented in an Explanation of Significant Difference (AFBCA, 1998e).

The excavation remedy was documented in the Closure Report for Soil Operable Unit Site 65 and Remedial Action Characterization Report for Soil Operable Unit Sites 56, 59, 60, and 62 (Montgomery Watson, 1997b). The additional in situ treatment remedy is described in the Informal Technical Information Report and Preliminary Engineering Report for Vadose Zone Source Removal at Sites 18, 23, and 59 (Montgomery Watson, 1999r).

The remedial action is expected to be completed and Site SD-59 closed within five years. However, a policy review is appropriate to maintain continuity from the previous review.

2.4.9 IRP Site SD-60

Site SD-60 was the Maintenance Dock North oil-water separator, Facility 6900. The COCs identified in the ROD are xylenes and TPH-g. The cleanup standards established in the ROD are presented in Table 5.

The remedial action selected for Site SD-60 included the following major components:

- Excavating approximately 350 yd³ of contaminated shallow soils to remove all contamination above acceptable levels;
- Transporting the excavated soils to the on-base ex situ bioremediation facility;
- Treating the excavated soils by ex situ bioremediation as appropriate;
- Transporting the treated soils to, and consolidating them with landfill cap foundation materials at Site LF-04 or Site WP-07, as appropriate; and
- Monitoring the groundwater if contamination that threatens groundwater quality remains at the site.

The excavation remedy was implemented according to the ROD. However, some contamination remained and additional excavation was not practical due to the depth limitations and the proximity of the adjacent aircraft maintenance hangar. Therefore the Air Force decided to initiate additional remedial action by in situ treatment.

The excavation remedy was documented in the Closure Report for Soil Operable Unit Site 65 and Remedial Action Characterization Report for Soil Operable Unit Sites 56, 59, 60, and 62 (Montgomery Watson, 1997b). Documentation of the additional in situ treatment remedy are contained in the Technical Information Report for Remedial Action at Sites 56 and 60 (Montgomery Watson, 1999g), and the Operations and Maintenance Manual and Manufacturers Literature for Soil Vapor Extraction/ Bioventing Systems at Sites 56 and 60 (Montgomery Watson, 1998p).

The remedial action was completed, and a remedial action report issued in December 2001 (Montgomery Watson 2001n); U.S. EPA and State concurrence were obtained in January and February 2002, respectively (U.S. EPA, 2002a; DTSC, 2002a). Therefore, no five-year review is required for Site SD-60.

2.4.10 IRP Site OT-62

Site 62 was the Old Jet Engine Test Stand (Facility 7099), including oil-water separator(OWS) 7110. The COCs identified in the ROD are metals, PAHs, and TPH-d. The cleanup standards established in the ROD are presented in Table 5.

The remedial action selected for Site OT-62 includes the following major components:

- Excavating approximately 500 yd³ of contaminated surface and shallow soils to remove all contamination above acceptable levels;
- Transporting the excavated soils to the on-base ex situ bioremediation facility;
- Treating the excavated soils by ex situ bioremediation as appropriate;
- Transporting the treated soils to, and consolidating them with landfill cap foundation materials at Site LF-04 or Site WP-07, as appropriate; and
- Monitoring the groundwater if contamination that threatens groundwater quality remains at the site.

The contaminated soil at Site OT-62 was excavated in accordance with the remedial action selected in the ROD. The excavation remedy was accomplished in two phases; the first is documented in the Closure Report for Soil Operable Unit Site 65 and Remedial Action Characterization Report for Soil Operable Unit Sites 56, 59, 60, and 62 (Montgomery Watson, 1997b), in which additional excavation is recommended. The additional excavation was completed, and documented in the Closure Report and Remedial Action Characterization Report for Soil Operable Unit Site 62 (Montgomery Watson, 1997k). A remedial action report was issued (AFBCA, 2001a) and U.S. EPA concurrence was obtained on June 11, 2001 (U.S. EPA, 2001a). Therefore, a five-year review is not necessary for Site OT-62.

2.4.11 Site SD-65

Site SD-65 is the former location of oil-water separator (OWS) 6910 that served the Aerospace Ground Equipment (AGE) shop at Building 7009. The COCs identified at Site SD-65 were chromium, lead, diesel, gasoline, and oil and grease.

The remedial action selected for Site SD-65 included the following major components:

- Excavating approximately 900 yd³ of contaminated surface and shallow soils to remove all contamination above acceptable levels;
- Transporting the excavated surface soils to an off-base disposal facility;
- Transporting the excavated shallow soils to the on-base ex situ bioremediation facility;
- Treating the excavated shallow soils by ex situ bioremediation as appropriate;

- Transporting the treated soils, and consolidating them with landfill cap foundation materials at Site LF-04 or Site WP-07, as appropriate; and
- Monitoring the groundwater if contamination that threatens groundwater quality remains at the site.

The remedial action was accomplished in 1996, and documented in the Closure Report for Soil Operable Unit Site 65 and Remedial Action Characterization Report for Soil Operable Unit Sites 56, 59, 60, and 62 (Montgomery Watson, 1997b). A remedial action report was issued in 2000 (AFBCA, 2000a), and obtained U.S. EPA concurrence (U.S. EPA, 2000b). The excavation remedial action achieved the cleanup levels, and therefore, a five-year review is not required for Site SD-65.

2.4.12 IRP Site OT-69

Site OT-69 was the Open Burn/ Open Detonation Pit. The COCs identified in the ROD are metals, dioxins, and furans. The cleanup standards established in the ROD are presented in Table 5.

The remedial action selected for Site OT-69 included the following major components:

- Removing surface water, if present, by pumping and discharging to the POTW;
- Excavating approximately 8,680 yd³ of contaminated sediments and surface soils to remove all contamination above acceptable levels;
- Transporting the excavated sediments and surface soils to, and consolidating them with landfill cap foundation materials at Site LF-04, as appropriate; and
- Monitoring surface water as appropriate if contamination remains at the site that threatens surface water quality.

Surface soil was removed from Site OT-69 during the landfill consolidation as part of the remedial action for the Landfill Operable Unit sites, and incorporated into the foundation of landfill Site 4. Confirmation sampling was conducted under a subsequent contract (Montgomery Watson, 1998g). Sediment was excavated from the drainage at the site in 1999 to complete the remedial action (Montgomery Watson, 2000b). The remedial action completion was documented in a remedial action report (AFRPA, 2003g) and obtained U.S. EPA concurrence on October 16, 2003 (EPA 2003b). Therefore a five-year review is not required for Site OT-69.

2.5 Landfill Operable Unit History and Contamination Summary

Contamination exists at the Landfill OU sites as a result of past military operations conducted between 1918 and 1974. The landfills were mainly used for the disposal of general and sanitary refuse. In addition to garbage and household trash, it was reported that petroleum, oil, and lubricant (POL) wastes, as well as waste solvents, primarily trichloroethene (TCE), may have been disposed in the landfills. It was also reported that daily burning of the refuse occurred at two of the landfills (Sites LF-03 and LF-04).

Investigations of the landfill sites are reported in the following documents:

- IRP Records Search for Mather AFB, Phase I, June 1982 [CH2M-Hill, Inc., 1982];
- IRP Phase II, Stage 2 Investigation, June 1987 [AeroVironment 1987];
- Sampling and Analysis Report for Site Monitoring Wells [IT, 1990a];
- Quarterly Routine Groundwater Sampling, 1990 to present [EA 1990a, 1990b, 1991], [IT Corp, 1991a, b; 1992a,c, d, e; 1993a, d, e, h; 1994a, b, c, e; 1995a,c, d, e; 1996a]; [Montgomery Watson, 1996a, b, c; 1997a, c, d, f, j; 1998a, c, f, h, m, 1999k, s, t, v; 2000j, p, r, t; 2001e, f, h, k; MWH 2002a, f, g, h; 2003d, de, h];
- Landfill Gas Testing Report, July 1988 [IT 1988];
- Site Inspection Report, August 1990 [IT 1990b];
- Group 2 Sites Remedial Investigation Report, April 1993 [IT 1993c];
- Solid Waste Assessment Test Report, March 1993 [IT 1993b]; and
- Landfill OU Focused Feasibility Study (FFS) Report, October 1993 [IT 1993g].

Five IRP sites were selected for remediation in the Record of Decision for the Landfill Operable Unit (AFBCA, 1995). Sites LF-03 and LF-04 are capped landfills, where the remedy is in place but at which unrestricted land use is not allowed; therefore these sites require a statutory five-year review. The other sites have been successfully remediated, with groundwater monitoring continuing in accordance with the ROD. A brief history of each of these sites follows.

2.5.1 IRP Site LF-02

Site LF-02 is located northwest of the Aircraft Control and Warning (AC&W) OU Site Area along the western fence-line of the former Strategic Air Command (SAC) alert parking apron (see Figure 1). The site was reportedly the main sanitary landfill for the Base from 1942 to 1950. Limited information is available concerning past operations conducted at the landfill.

The Landfill Operable Unit ROD selected capping as the remedial action. However, two changes were made after the ROD that altered the remedy.

During site preparation, as soil containing sporadic waste was removed from a drainage swale, it was determined that consolidation within Site LF-02 would raise the cap to a degree that it would require relocating overhead power lines, and a decision was made to dispose of the soil and waste from the Site LF-02 drainage swale at the Site LF-04 consolidation site. This decision was documented in the Explanation of Significant Differences from the Landfill Operable Unit Record of Decision (AFBCA, 1996e).

As work progressed, it became apparent that there was less waste at Site LF-02 than estimated in the Landfill OU Focused Feasibility Study (FS) (IT Corp., 1993g) and that it would be cost-effective to consolidate the remaining contents of Site LF-02 into the Site LF-04 landfill. This decision was documented in a time-critical removal action memorandum (AFBCA, 1996c) in order to accomplish the consolidation without extending the Site LF-04 operations into wet winter weather at additional cost. The waste was successfully removed, and groundwater monitoring for three years detected no significant contamination associated with Site LF-02 (AFBCA, 2000b). Groundwater monitoring for Site LF-02 was terminated in 2000 after the Basewide OU ROD documented that no further action was required at Site LF-02.

The Basewide OU ROD (AFBCA, 1998b) confirmed that the removal action for Site LF-02 constituted the final remedial action for Site LF-02. A remedial action report was issued in 2000 (AFBCA, 2000b), and obtained U.S. EPA concurrence on September 25, 2000 (U.S. EPA, 2000a). Therefore no five-year review is required for Site LF-02.

2.5.2 IRP Site LF-03

Site LF-03 was reportedly the main sanitary landfill for the Base from 1950 through 1967. Site LF-03 is located in the northeast corner of the Mather (see Figure 1). Refuse was reportedly placed in trenches, burned, and covered daily. The backfilled trenches were discernable at the surface of the site where settlement of the refuse and surface cover cracking had occurred. In addition to refuse, the following items were also reportedly disposed at this site: drummed POL wastes; hospital wastes; waste paint and thinners; and empty pesticide containers.

The Landfill Operable Unit ROD (AFBCA, 1995) selected capping as the remedial action. The site was capped in 1996; gas monitoring and groundwater monitoring continue. The monitoring results are reported in regular landfill reports and groundwater monitoring reports (i.e. MWH, 2002 and MWH 2003). Gas monitoring has showed compliance with Applicable or Relevant and Appropriate Requirement (ARARs), i.e. no methane concentrations exceeding 5% at the site boundary. The remedial action requires a minimum of thirty years of post-closure monitoring and maintenance; and may not permit unrestricted use even if monitoring one day ends. Therefore, a statutory five-year review is required for Site LF-03.

2.5.3 IRP Site LF-04

Site LF-04 is adjacent to and east of Site LF-03 (see Figure 1), and was reportedly the main sanitary landfill site for the entire Base from 1967 through 1971. Operations were reportedly similar to those conducted at Site LF-03, and included daily filling, burning, and covering operations. During the site investigations, the trenches were discernable across the surface due to settling and extensive surface cracking. A POL waste disposal pit was reportedly located at the northeast corner of the site and was in operation for approximately two years during the late 1960s. Trichloroethene (TCE) was thought to have possibly been present in the POL waste, but tetrachloroethene (also known as PCE) and cis-1,2-dichloroethene (DCE) are the primary groundwater contaminants in the area.

The Landfill Operable Unit ROD (AFBCA, 1995) selected capping as the remedial action, in conjunction with consolidation of wastes from sites LF-05 and LF-06. Later, as explained above, waste from Site LF-02 was also consolidated at Site LF-04. The Landfill Operable Unit ROD selected capping as the remedial action. The site was capped in 1996, with vegetation completed in 1997; gas monitoring and groundwater monitoring continue.

Initial gas monitoring after capping revealed that methane gas exceeded the 5% limit at the compliance monitoring boundary on the north and west of the Site LF-04 landfill. An alternate compliance boundary was established on the west side, and additional gas migration monitoring wells were installed to monitor this new boundary. A series of intercept trenches was installed on the north side in 1998, and methane concentrations have been in compliance since August 1999. The vents from the intercept trenches have exhibited quarterly methane concentrations that have often exceeded 5%, having a pattern that may indicate buildup of methane during the wet season and release in dryer months, or may be barometrically controlled. Only two results have exceeded 30% methane in the last three years. However, the compliance wells in this vicinity measured have been less than 0.5% methane over this period. A contingency plan addresses the additional actions that will be taken to reduce the methane migration should it persist in excess of the 5% limit, or if development occurs on the adjacent land such that the landfill gas migration poses an unacceptable health risk (Montgomery Watson, 1999c).

Landfill Site LF-04 is also the apparent source for groundwater contamination being monitored as part of the Northeast Plume, described elsewhere in this report.

The remedial action requires a minimum of thirty years of post-closure monitoring and maintenance. The monitoring results are reported in regular landfill reports and groundwater monitoring reports. The remedial action requires a minimum of thirty years of post-closure monitoring and maintenance; and may not permit unrestricted use even if monitoring one day ends. Therefore, a statutory five-year review is required for Site LF-04.

2.5.4 IRP Site LF-05

Site LF-05, which was located south of Site LF-04, was the main sanitary landfill during 1971 (see Figure 1). This site consisted of two major east-west trending trenches and an apparently narrower trench, which extends further to the east. The location of the major trenches was visible due to extensive cracking and settling of the surface soils. Following disposal in the landfill, the wastes were covered without being burned. Small quantities of drummed POL wastes may have been disposed at this site.

The selected remedy for Site LF-05 was excavation and consolidation (AFBCA, 1995). The major components of this remedy included:

- Excavating the landfill materials;
- Transporting the material to, and consolidating it with the landfill materials at Site LF-04; and
- Monitoring the groundwater.

The remedial action for Site LF-05 was accomplished in 1996. Groundwater monitoring has continued since, with the only constituent detected being 1,2-dichloropropane (1,2-DCP). 1,2-DCP has been detected in two monitoring wells at about half its cleanup standard for the Northeast Plume. Although this historic pattern of no groundwater detections above cleanup standards associated with Site LF-05 continues, monitoring of these two wells, MAFB-139 and -141, continues under the Northeast Plume monitoring program. Groundwater monitoring will continue for the Northeast Plume as appropriate. A remedial action report will be prepared for this site to obtain U.S. EPA concurrence on closure of this site. However, as there is no waste associated with Site LF-05 left in place, a five-year review is not required for this site. The groundwater detections near Site LF-05 are reviewed as part of the Northeast Plume.

2.5.5 IRP Site LF-06

Site LF-06 was located in the southeastern portion of Mather and was the main sanitary landfill site for the Base from 1972 through 1974 (see Figure 1). Site LF-06 consisted of two soil-covered landfills, one north and one south of an intermittent stream channel.

Refuse (primarily garbage and household trash) was dumped into the landfill trenches. Small quantities of drummed used and unused paint thinners, and POL wastes were reportedly disposed at this site. Extensive settling and surface cracking of the surface soil was evident at both landfills.

The selected remedy for Site LF-06 was excavation and consolidation. The major components of this remedy included:

- Excavating the landfill materials;
- Transporting the material to, and consolidating it with the landfill materials at Site LF-04; and
- Monitoring the groundwater.

The waste consolidation for the remedial action for Site LF-06 was accomplished in 1996. Groundwater monitoring following the waste removal had no detections of organic contaminants. However, elevated concentrations of metals were detected in the groundwater, most notably from the most upgradient well, MAFB-142, where concentrations of chromium, nickel, and lead exceeded MCLs in some samples. It was thought that these detections were caused by the stainless steel well screen in the monitoring wells, as the metals are all used in stainless steel alloys. Therefore additional pumping was conducted from MAFB-142 in the first quarter 2001 to see if sampling after removing near-field water would result in lower concentrations (Montgomery Watson, 2001e). Indeed, only trace concentrations of metals were detected during and after this pumping. Therefore, cessation of monitoring was proposed at a meeting in April 2002 (AFBCA 2002b) to the remedial project managers, and monitoring at Site 6 ceased after second quarter 2002. Through a misunderstanding, regulatory concurrence was not received until April 2003.

There is no waste associated with Site LF-06 left in place, and historic detections of metals in groundwater were apparently related to the well construction rather than any release from Site LF-06. A remedial action report will be prepared for this site to obtain U.S. EPA concurrence on closure of this site. Therefore, no five-year review is required for this site.

2.6 Basewide OU History and Contamination Summary

Six IRP sites were selected for remediation in the Record of Decision for the Basewide Operable Unit (AFBCA, 1998b), five of which received a five-year policy review reported herein. These five sites are Site FT-10C/ST-68 (counted here as two sites), Site LF-018, Site OT-23, and Site OT-87. The sixth site, Site OT-86, has been remediated and U.S. EPA concurrence with the Remedial Action Report (AFRPA, 2003h) was issued in October (U.S. EPA, 2003c). The remedial action at Site OT-87 resulted in lead concentrations remaining in soils such that unrestricted land use is not authorized, requires a statutory review, which is included in this five-year review report. A brief

history of each of these sites follows. Some sites are grouped together because of a common remedial action.

2.6.1 IRP Site FT-10C/ST-68

Site FT-10C was the site of fire training exercises from approximately 1947 - 1958. Site ST-68 is the adjacent site where a fuel storage facility once consisted of sixteen 50,000-gallon underground storage tanks used to store JP-4 jet fuel, as well as a fuel distribution manifold, pumps, and two associated 2,000-gallon tanks. The location of these sites in relation to the groundwater plumes is shown in Figure 9.

Site FT-10C was discovered during installation of groundwater monitoring wells; subsequent exploratory excavation revealed some buried debris and petroleum-contaminated soil. Prior to this discovery, IRP Site FT-10 was thought to be the location of the former fire training exercises. Reevaluation of historical aerial photography revealed that the Site FT-10 location had been misidentified, and that Site FT-10C does match the apparent fire training location on historic aerial photographs. After site investigation, the debris and associated soil was excavated and disposed of at the Site LF-04 landfill under a removal action memorandum (AFBCA, 1996d).

The Basewide OU ROD selected in situ treatment as the remedial action to address the remaining COCs at sites FT-10C and ST-68. The COCs designated by the ROD are petroleum constituents and carbon tetrachloride for Site FT-10C, and petroleum measured as gasoline at Site ST-68. The COCs and cleanup levels established in the ROD are listed in Table 5. Both soil vapor extraction and bioventing have been used as part of the remedy. Additional debris, presumably related to fire training, has been discovered also during the remedial action. Debris and contaminated soil have been excavated, and additional extraction and monitoring wells have been added to the remedial system. Mass removal reached about 15,000 pounds of contaminants in 2001, after which the system was shut down for rebound testing and system expansion. The system now operates to address the remaining hot spots of contamination, and the mass removal rate has dropped accordingly.

The remedial action may take more than five years to attain the cleanup standards. Therefore a five-year policy review is appropriate.

2.6.2 IRP Site LF-18

Site LF-18 is located adjacent to the aircraft-parking apron at the west end of the Main Base flight line. Originally identified as an IRP site because tool boxes and containerized ethyl mercaptan were reported buried there, no buried material was discovered during investigations, but the site was found to have chlorinated volatile organic contamination in the soil. This is thought to have resulted from aircraft washing activities on the nearby

apron; an historic aerial photograph shows water ponded at Site LF-18. The location of this site in relation to the groundwater plumes is shown in Figure 9.

The COCs and cleanup levels established in the ROD are listed in Table 5. Pilot tests confirmed that soil vapor extraction is effectively able to remove chlorinated solvents from the soil at Site LF-18, and a soil vapor extraction system was constructed in 1999 (Montgomery Watson 1999r) and began operation in 2000 (Montgomery Watson, 2000k) in accordance with the remedial action selected in the ROD (AFBCA, 1998b). As of July 2003, about 1775 pounds of contaminants had been removed from Site 18 by the SVE system. The removal rate has decreased but as of mid-2003 was still over a pound per day (MWH 2003f).

The remedial action may take more than five years to attain the cleanup standards. Therefore a five-year policy review is appropriate.

2.6.3 IRP Site OT-23

Site OT-23 was originally identified and defined as two sections of the sanitary sewer line identified as leaky. During the Group 2 remedial investigation (RI), the site was redefined to consist of all the sewer lines on the Main Base that drained buildings where TCE was reported as stored or used in the Records Search (CH2M Hill, 1982). Sampling from soil borings during the Group 2 RI identified no significant contamination associated with Site OT-23. During the Additional Site Characterization, an additional investigation focused on the portions of the sanitary sewer line that were located above water table contamination. A sewer line flushing and soil gas survey was conducted along the suspect lines, and although no significant contaminants were found within the sewer lines, contamination was identified in some of the soil gas samples collected in borings near the sewer lines. On this basis, the Basewide ROD (AFBCA 1998b) identifies four areas (subsites 23a, 23b, 23c, and 23d) to be addressed during remedial action. Most of these sites are near other IRP sites undergoing SVE, and are being addressed by those remedial actions.

Subsite 23a	Addressed by Site LF-18 remedial action
Subsite 23b	Addressed by Site ST-37/ST-39/SS-54 remedial action
Subsite 23c	Based on soil gas detections at 70 and 80 feet below ground surface, apparently associated with groundwater contamination
Subsite 23d	Addressed by Site ST-37/ST-39/SS-54 remedial action

An additional location along Site OT-23 was defined in 1998, near the site of a former dry cleaning plant where a major source of PCE contamination found. The contamination near the dry cleaning plant site has often been referred to as Site OT-23C, as the 23c identified in the ROD (AFBCA 1998b) appears to be related to the source at the former

dry cleaning location. The location of Site OT-23C in relation to the groundwater plumes is shown in Figure 9.

Subsite OT-23C (dry cleaning plant) Addressed by Site 23 SVE system

The COCs and cleanup levels established in the ROD are listed in Table 5.

The soil vapor extraction system for the part of Site OT-23 near the former dry cleaning plant was constructed in 1999 (Montgomery Watson, 1999r) and began operation in 2000 (MWH, 2000k). As of mid-2003, about 3400 pounds of reactive organic compounds (emissions limits are regulated by the Sacramento Metropolitan Air Quality Management District as total reactive organic compounds, which is the same as the total of volatile organic compounds) had been extracted by the Site OT-23 treatment system; about 1750 pounds of this was PCE. The extraction rates during the first half of 2003 ranged up to 2 pounds per day.

The remedial action may take more than five years to attain the cleanup standards. Therefore a five-year policy review is appropriate.

2.6.4 IRP Site OT-86

IRP Site OT-86 was the small arms range for Mather, located in the southeastern portion of Mather, just east of Eagles Nest Road and north of Kiefer Boulevard. Lead was identified as the only COC in the ROD, as listed with its cleanup value of 130mg/kg (ppm), in Table 5.

Uncontaminated portions of the backstop soil was excavated in 1996 and used during the landfill consolidation project. The remaining contaminated soil and bullet fragments were removed in 1998, processed to remove recoverable lead, and stabilized as necessary for use in building the foundation for the Site WP-07 cap. The project was completed in 1999, and documented in the Informal Technical Information Report for Remedial Action at Sites 15, 20, 85, 86, and 87 (Montgomery Watson, 1999s). A remedial action report was issued for Site OT-86 (AFRPA, 2003h) and received concurrence from U.S. EPA on October 23, 2003 (U.S. EPA, 2003c), and no comment from DTSC (DTSC, 2003). Therefore, a five-year review is not required for Site OT-86.

2.6.5 IRP Site OT-87

Site OT-87 was a skeet and trap range at Mather located near the AC&W Site. It contained an area where clay pigeon fragments had accumulated, and an area of lead shot that encompassed part of Morrison Creek. The COCs and cleanup levels established in the ROD (AFBCA, 1998b) are listed in Table 5.

Remedial action consisting of excavation and stabilization was selected in the ROD. The contaminated soil, clay pigeon material, and lead shot were excavated in 1998. The soil was processed to remove recoverable lead, and stabilized as necessary for use in building the foundation for the Site WP-07 cap. The project was completed in 1999, and documented in the Informal Technical Information Report for Remedial Action at Sites 15, 20, 85, 86, and 87 (Montgomery Watson, 1999s). Full closure for Site OT-87 will be addressed in a separate remedial action report.

The remedial action was conducted with the cleanup standard for lead inconsistent with residential use. Therefore, unrestricted use of the property is not be permitted Institutional controls are in place as a part of the remedy, currently through Air Force ownership of the property and conditions in the lease to Sacramento County. Therefore a statutory review is required and reported herein.

2.7 Supplemental Basewide OU History and Contamination Summary

The Supplemental Basewide Operable Unit 6 consists of IRP sites SD-80, SD-85, DD-88, and OT-89. The cleanup of these sites has been accomplished by removal action authority. A Record of Decision for these sites has been in dispute since 2001. Once the ROD is issued, the closure of these sites may be addressed. A brief history of each of these sites follows.

2.7.1 IRP Site SD-80

Site SD-80 is the Golf Course Maintenance Area Ditch. It was investigated during the Additional Site Characterization Remedial Investigation (IT Corp., 1996b). The potential COCs identified in the Basewide OU Focused Feasibility Study Report (IT Corp., 1997) are pesticides; however, cleanup standards were not agreed upon in time for the Basewide OU ROD. Consequently, additional site data was been collected and the site was incorporated into the **Supplemental** Basewide OU. The site data was evaluated in the Supplemental Basewide OU FFS (IT Corp., 2000) and the Draft Final Supplemental Basewide OU ROD (AFBCA, 2001d)

Excavation of contaminated sediment at Site SD-80 was conducted in 1999 under a removal action memorandum (AFBCA, 1999b) in order that the excavated sediment could be used for landfill cap foundation material at Site WP-07 (Montgomery Watson, 2000b), and again in portions of the site in 2001 (MWH, 2002e) after the scope of the removal action was revised (AFBCA, 2001b) based upon the cleanup standards developed for the Draft Final Record of Decision for the Supplemental Basewide Operable Unit (AFBCA, 2001d). The removal action may be sufficient to satisfy the final cleanup criteria; this will be assessed based upon the cleanup standards to be established in the ROD. It is anticipated that cleanup will be done within five years of the Supplemental Basewide OU ROD, and that it will result in unrestricted land use.

Therefore, if cleanup is accomplished within five years of the Supplemental Basewide OU ROD, a five-year review will not be required for Site SD-80.

2.7.2 IRP Site SD-85

Site SD-85 is the South Ditch, an engineered drainage ditch that collects storm runoff from the southern half of Mather, as well as from the northern half via the Site SD-15 (West Ditch) and the Site SD-13 ditches. Site 85 was investigated as part of the Additional Site Characterization Remedial Investigation (IT Corp., 1996b). The potential COCs identified in the Basewide OU Focused Feasibility Study report are pesticides, polynuclear aromatic hydrocarbons, metals, and petroleum hydrocarbons (IT Corp., 1997). However, cleanup standards for pesticides were not agreed upon in time for the Basewide OU ROD. Consequently, Site SD-85 is incorporated into the **Supplemental** Basewide OU. The site data is evaluated in the Draft Supplemental Basewide OU FFS (IT, 2000), and the Draft Final Supplemental Basewide OU ROD (AFBCA, 2001d).

While additional information was being collected at sites SD-80 and DD-88 in an effort to reach agreement on cleanup standards for pesticides, a removal action memorandum was issued for Site SD-85 (AFBCA, 1997b), and excavation was undertaken in 1998 to remove contamination from the Site SD-85 ditch. The project was completed in 1998, and documented in Informal Technical Information Report for Remedial Action at Sites 15, 20, 85, 86, and 87 (Montgomery Watson, 1999s). The scope of the removal action was revised (AFBCA, 2001b) based upon the cleanup standards developed for the Draft Final Record of Decision for the Supplemental Basewide Operable Unit (AFBCA, 2001d), and additional excavation occurred in 2001 (MWH, 2002e). The removal action may be sufficient to satisfy the final cleanup criteria; this will be assessed based upon the cleanup standards to be established in the ROD.

It is anticipated that cleanup will be done within five years of the Supplemental Basewide OU ROD, and that it will result in unrestricted land use. Therefore, if cleanup is accomplished within five years of the Supplemental Basewide OU ROD, a five-year review will not be required for Site SD-85. Once cleanup standards are established in the ROD for the Supplemental Operable Unit for Site SD-85, site closure for Site SD-85 will be reassessed and documented in a separate remedial action report.

2.7.3 IRP Site DD-88

Site DD-88 is the Morrison Creek Reference Site. It was investigated during the Additional Site Characterization Remedial Investigation (IT Corp., 1996b). The potential COCs identified in the Basewide OU Focused Feasibility Study report are pesticides; however, cleanup standards were not agreed upon in time for the Basewide OU ROD. Consequently, additional site data has been collected and the site is incorporated into the Supplemental Basewide OU. The potential COCs identified in the Basewide OU Focused Feasibility Study report are pesticides; however, cleanup standards were not agreed upon in time for the Basewide OU ROD. Consequently, additional site data was collected and

the site was incorporated into the Supplemental Basewide OU. The site data was evaluated in the Supplemental Basewide OU FFS (IT Corp., 2000) and the Draft Final Supplemental Basewide OU ROD (AFBCA, 2001d).

Excavation of contaminated sediment at Site 88 was conducted in 1999 under a removal action memorandum (AFBCA 1999b) in order that the excavated sediment could be used for landfill cap foundation material at Site WP-07 (Montgomery Watson, 2000b), and again in portions of the site in 2001 after the scope of the removal action was revised (AFBCA, 2001b; MWH, 2002e) based upon the cleanup standards developed for the Draft Final Record of Decision for the Supplemental Basewide Operable Unit (AFBCA, 2001d). The removal action may be sufficient to satisfy the final cleanup criteria; this will be assessed based upon the cleanup standards to be established in the ROD. It is anticipated that cleanup will be done within five years of the Supplemental Basewide OU ROD, and that it will result in unrestricted land use. Therefore, if cleanup is accomplished within five years of the Supplemental Basewide OU ROD, a five-year review will not be required for Site DD-88.

2.7.4 IRP Site OT-89

Site OT-89 is the site of a historic trap range that was used in the 1940s and 1950s. An investigation revealed that the two sets of firing stations were removed in the 1950s, and that the shot-fall area of one of these was covered with imported fill to a depth of approximately 8 – 10 feet. A pilot study was conducted during the remedial action for Site OT-87, to see if the soil from Site OT-89, containing lead shot, could be successfully cleaned using the same stabilization technology used for Site OT-87 (Montgomery Watson, 2000a). The site data is evaluated in the Supplemental Basewide OU FFS (IT Corp, 2000), and in the Draft Final ROD for the Supplemental Operable Unit (AFBCA, 2001d). Additional excavation of contaminated soil was conducted in 2001 under removal authority (AFBCA, 2001c).

It is expected that remedial action at Site OT-89 will not allow for unrestricted land use. Currently, land use at Site OT-89 is restricted by Air Force ownership and conditions of the lease to Sacramento County; physical access is also restricted by a perimeter fence around Mather Airport. A statutory five-year review will be required when the next five-years review is conducted. However, as the ROD has not yet been issued, the five-year review for Site OT-89 consists merely of the information in this section.

2.8 Community Participation

Information on community participation can be found in the Community Relations Plan for Mather AFB (AFBCA, 1999a; see also AFBCA, 1996a), which summarizes the history of public participation in the environmental cleanup at Mather. Prior to the formation of the Restoration Advisory Board (RAB) in 1994, public meetings were held at key milestones in the environmental cleanup program, such as when the Proposed Plan for the AC&W Site (Site WP 12) was issued for public comment in 1991 and again in

1992, or when alternative water supplies were being coordinated in the mid-1980's. In addition, Technical Review Committee meetings were held approximately four times a year from 1989 to 1993, and attended by a public member as well as representatives of elected officials.

Since 1994, the Restoration Advisory Board (RAB) has served to provide a greater opportunity for members of the public to learn about Mather's environmental cleanup program, to review and comment on environmental plans and reports, and to provide input to the Air Force and regulatory agencies on cleanup decisions. The RAB consists of up to a dozen community members, and is co-chaired by a community member and the BRAC Environmental Coordinator for Mather. The RAB holds regular meetings open to the public, and meeting minutes are distributed to a mailing list of interested people. From 1994 through 1998, the RAB met approximately every six weeks. As of 2002, the RAB will meet about six times per year.

The Community Relations Program is more fully described in the Community Relations Plan for Mather (AFBCA, 1999a), an update of which will be issued in 2004.

The public participation requirement of CERCLA Sections 113(k)(2)(B)(i-v) and 117 were met through public comment periods and public meetings to address the Proposed Plan and content of supporting Remedial Investigation Feasibility Study (RI/FS) documents for each of the first five operable units, as tabulated below. Responses to public comments received during each of the public comment periods are incorporated in the Responsiveness Summary section of the Record of Decision documents.

Table 4 summarizes the public comment periods for Mather's proposed plans.

Table 4: Public Participation in Remedy Selections for Mather

Operable Unit	Public Comment Period	Public Meeting
AC&W	10/1 - 31/91 and 3/16 - 4/15/92	10/1/91 and 4/1/92
Landfill	2/1/94 - 3/3/94	2/15/94
Soil	5/8/95 - 6/7/95	5/18/95
Groundwater	5/8/95 - 6/7/95	5/18/95
Basewide	5/23 - 6/23/97	5/29/97
Supplemental Basewide	9/26 - 10/26/00	10/10/00

Public comments on this five-year review report were accepted during a sixty-day review period from February 6 through April 6, 2004, beginning with the issuance of the draft report. This is the period for formal review by the U.S. EPA, California EPA, and the RAB. No public comments were received by the RAB so the RAB comments were developed by the RAB membership.

3.0 BACKGROUND INFORMATION ON MATHER

U.S. EPA guidance on the format for five-year review reports recommends that background information be provided. This section provides an overview for Mather as a whole, leaving site-specific information for the discussion of each contaminated site.

3.1 Physical Characteristics

Mather AFB (now closed, and called Mather) is located in the Sacramento Valley, approximately ten miles east of downtown Sacramento, California, just south of U.S. Highway 50. The formerly active base encompassed approximately 5,845 acres at the time of closure (129 acres of easements) in an unsurveyed part of Township 8 North, Ranges 6 East and 7 East.

Mather sits on the floor of the Sacramento Valley, east of the Sacramento River, on alluvial sediments that slope gently westward toward the river. There are three major terraces at Mather, formed by the progressive down-cutting of the American River as it migrated northward between episodes of glaciation. Each is oriented roughly northeast to southwest, with each terrace at higher elevation than the terrace to its north. Within each terrace there is development of drainage systems that are a part of the Morrison Creek drainage. Some of this drainage has been modified by creation of storm-water channels to accommodate development of Mather over the last century.

Much of the shallow soil at Mather is fine-grained ‘hardpan’ silt that serves as a barrier to infiltration of rainwater. There are significant areas of seasonal wetlands, many of which are vernal pools, which hold water through the winter rainy season and into the spring, supporting unique communities of plant and animal life. Beneath the hardpan are various layers of sediment that range in character from gravels to fine silts and clays. The water table occurs about 85 feet below the surface in the northwestern area of Mather. There is a greater depth to the water table at the higher elevation terraces, mostly because the land surface is at a higher elevation. The aquifers beneath Mather are also in valley-fill sediments with the same range of character from gravels to fine silts and clays. The upper few hundred feet is primarily derived from erosion of granitic source material, beneath which are greater proportions of sediments derived from erosion of volcanic source material.

3.2 Land Use

Mather AFB was constructed in 1918 and its primary mission was as a flight training school. The base operated continuously as a training base for aviators from 1942 until 1993. The base was decommissioned under the Base Closure and Realignment Act (BCRA) on September 30, 1993. A wing of the Strategic Air Command (SAC) was located at Mather AFB from the late 1950’s until 1989. The base closed in September 1993, and has been in transition to civilian use since then. About half the former base is now leased to Sacramento County for use as an airport. The airport is used for cargo and

general aviation. About a third of the base is leased to Sacramento County for use as parkland and a golf course. The golf course is planned for sale to Sacramento County in the near future. The military family housing has been sold and redeveloped. The previous military homes, numbering approximately 1200, are being replaced by a similar number of larger single family homes. Much of the rest of Mather has been leased or sold for business development. Other land uses at Mather are a National Guard station, a Veterans Affairs hospital, a residential job retraining facility, a day care facility, two Federal Aviation Administration radar facilities, two churches, and two elementary schools. The major change anticipated for the future is that the property now leased will eventually be deeded to Sacramento County.

3.3 History of Contamination

Military activities have occurred at Mather since 1918. Fulfillment of the military missions has involved use and generation of a wide range of toxic and hazardous chemicals including industrial solvents, aviation fuels, and a variety of oils and lubricants. The use and disposal of these chemicals has resulted in soil and groundwater contamination at many locations at Mather. In addition, landfills were operated at Mather for the disposal of garbage and trash, generated at Mather. Much of this was household waste, but there was also industrial waste generated, some of which may have been taken to these landfills. A dry cleaning plant was located at Mather in the 1950's and 1960's, resulting in groundwater contamination that has spread about two miles to the west. The routine application of pesticides also resulted in contamination of sediments at concentrations that is now believed to threaten aquatic life. As environmental awareness and regulation increased in the 1970's and 1980's, the Air Force mobilized to change the practices that caused release of contamination into the environment, and to address contamination that had resulted from past practices.

3.4 Initial Responses

The Installation Restoration Program (IRP) began in 1982 to identify locations at Mather AFB where hazardous substances or other pollutants might have been released to the environment. These previous investigations have confirmed the presence of volatile organic compounds and other hydrocarbons at several of the IRP sites. Based on this, the entire base was proposed for listing on the Superfund (CERCLA) National Priorities List (NPL) in July 1989, and was placed on the NPL on November 21, 1989. In July 1989, the USAF, the U.S. EPA, and the State of California signed a Federal Facility Agreement (FFA) (USAF, 1989) under CERCLA Section 120 to ensure that environmental impacts from past and present operations are thoroughly investigated and appropriate cleanup actions are taken to protect human health, welfare, and the environment. The FFA sets enforceable deadlines for documents, defines roles and responsibilities of each signatory party, and provides a vehicle for dispute resolution. The USAF is the owner of the site, the principal responsible party, and lead agency for conducting investigative and cleanup activities.

In parallel with the early site characterization activities and establishment of the formal FFA, the Air Force, working with the U.S. EPA and State regulatory agencies, addressed contamination discovered in private wells just to the west of Mather with a series of efforts to replace the contaminated drinking water supply. Bottled water was provided to residents whose water had contamination exceeding the State action level at the time, and eventually all these residences were connected to either the Mather water supply or the Citizens Utilities Company water supply.

3.5 Summary of Bases for Taking Action

Environmental contaminants that require cleanup have been discovered at Mather in soil, sediment, surface water, and groundwater. A list of the contaminants and the cleanup standards required for each are listed in Table 5 (for acronyms and initialisms, see pages iv – vi).

Exposure to significant concentrations of contaminants in soil, sediment, surface water, and/or groundwater is associated with unacceptable human health risks and/or ecological health risks. Cleanup has been required for contamination for which chemical concentrations exceed regulated thresholds, or for which concentrations exceed management criteria developed or accepted by the regulatory agencies and the Air Force. Public comment is also factored into the cleanup decisions. The over-riding basis for cleanup is protection of human health and the environment, as required by the Comprehensive Environmental Response, Compensation, and Liability Act.

Table 5: Cleanup Levels for Mather AFB IRP Sites
(all cleanup levels are established by record of decision)

IRP Site Number	Contaminant(s) of Concern	Cleanup Standard
LF-02	Not Applicable (N/A)	N/A
LF-03	N/A	N/A
LF-04	N/A	N/A
LF-05	N/A	N/A
LF-06	N/A	N/A
WP-07/FT-11	<i>Soil</i> Total petroleum hydrocarbons (TPH) as Diesel TPH as Gasoline	10 Parts Per Million (ppm) 1 ppm
FT-10C	<i>Soil</i> Carbon tetrachloride Benzene Ethylbenzene Toluene	Narrative Narrative Narrative Narrative

Table 5: Cleanup Levels for Mather AFB IRP Sites
(all cleanup levels are established by record of decision)

IRP Site Number	Contaminant(s) of Concern	Cleanup Standard
FT-10C (cont'd)	Xylenes	Narrative
	TPH as Diesel	100 ppm
	TPH as Gasoline	5 ppm
ST-68	TPH as Gasoline	5 ppm
WP-12	<i>Groundwater</i> Trichloroethene (TCE)	5 ug/l aquifer standard
SD-13	<i>Surface Water:</i> Aluminum Chromium Lead Manganese Silver Zinc <i>Sediment:</i> Arsenic Chromium Chromium VI Cobalt Copper Lead Mercury Nickel Vanadium Zinc 4,4-DDD 4,4-DDE 4,4-DDT alpha-Chlordane gamma-chlordane Dieldrin <i>Surface Soil:</i> Arsenic Mercury Zinc TPH as Diesel Oil and Grease Benzo(a)anthracene Benzo(g,h,i)perylene Fluoranthene Indeno(1,2,3-cd)pyrene Naphthalene Pyrene	6.28 ppm 11 Parts Per Billion (ppb) 9.4 ppb 100 ppb 16 ppb 54 ppb 16 ppm 176 ppm Non-Detect (ND) (100 ppb) 35 ppm 104 ppm 81 ppm ND (200 ppb) 81 ppm 153 ppm 116 ppm 1.9 ppm 1.3 ppm 1.3 ppm 340 ppb 340 ppb 28 ppb 16 ppm ND (200 ppb) 1559 ppm 100 ppm 430 ppm 330 ppb 330 ppb 330 ppb 330 ppb 330 ppb 330 ppb

Table 5: Cleanup Levels for Mather AFB IRP Sites
(all cleanup levels are established by record of decision)

IRP Site Number	Contaminant(s) of Concern	Cleanup Standard
SD-15	<i>Surface Water:</i>	
	Chromium	11 ppb
	Lead	9.4 ppb
	Manganese	100 ppb
	Vanadium	100 ppb
	Zinc	54 ppb
	<i>Sediment:</i>	
	Barium	1300 ppm
	Cadmium	1.4 ppm
	Chromium	176 ppm
	Chromium VI	ND (100 ppb)
	Copper	104 ppm
	Lead	81 ppm
	Mercury	ND (200 ppb)
	Zinc	116 ppm
	Alpha-Chlordane	340 ppb
	Gamma-Chlordane	340 ppb
	Aroclor 1248	66 ppb
	Aroclor 1254	66 ppb
	Aroclor 1260	66 ppb
	Dieldrin	28 ppb
	TPH as Diesel	10 ppm
	TPH as Gasoline	1 ppm
	Oil and Grease	430 ppm
	Acenaphthene	330 ppb
	Acenaphthylene	330 ppb
	Anthracene	330 ppb
	Benzo(a)anthracene	330 ppb
	Benzo(a)pyrene	330 ppb
	Benzo(b)fluoranthene	330 ppb
	Benzo(g,h,i)perylene	330 ppb
	Benzo(k)fluoranthene	330 ppb
	Chrysene	330 ppb
	Dibenzo(a,h)anthracene	330 ppb
	Fluoranthene	330 ppb
	Fluorene	330 ppb
	Indeno(1,2,3-cd)pyrene	330 ppb
	Napthalene	330 ppb
	Phenanthrene	330 ppb
	Pyrene	330 ppb
LF-18	<i>Soil vapor:</i>	
	Trichloroethene	Narrative
	1,2-DCE	Narrative

Table 5: Cleanup Levels for Mather AFB IRP Sites
(all cleanup levels are established by record of decision)

IRP Site Number	Contaminant(s) of Concern	Cleanup Standard
ST-20	<i>Surface Soil (sludge location, Soil Operable Unit):</i> Lead Mercury Zinc <i>Surface Soil (Basewide OU):</i> Lead Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Phenanthrene <i>Subsurface Soil: (Basewide OU)</i> TPH as Diesel	130 ppm 20 ppm 1559 ppm 130 ppm 330 ppb 330 ppb 330 ppb 330 ppb 330 ppb 330 ppb 10 ppm
OT-23	<i>Soil Vapor:</i> PCE TCE 1,2 DCE Xylenes	Narrative Narrative Narrative Narrative
ST-37	<i>Subsurface Soil:</i> TPH as Diesel TPH as Gasoline Oil and Grease	10 ppm 1 ppm 430 ppm
ST-39	<i>Surface Soil:</i> TPH as Diesel Oil and Grease <i>Subsurface Soil:</i> Benzene Ethylbenzene Toluene Xylene TPH as Diesel TPH as Gasoline	100 ppm 430 ppm 100 ppb 2.9 ppm 4.2 ppm 1.7 ppm 10 ppm 1 ppm
SS-54	<i>Subsurface Soil</i> Benzene TPH as Gasoline	100 ppb 1 ppm
SD-56	<i>Surface Soil:</i> Arsenic Lead Benzo(a)anthracene	22 ppm 130 ppm 330 ppb

Table 5: Cleanup Levels for Mather AFB IRP Sites
(all cleanup levels are established by record of decision)

IRP Site Number	Contaminant(s) of Concern	Cleanup Standard
SD-56 (continued)	Benzo(a)pyrene Benzo(b)fluoranthene Chrysene Dibenzo(a,h)anthracene TPH as Diesel Oil and Grease <i>Subsurface Soil:</i> TPH as Diesel TPH as Gasoline Oil and Grease	330 ppb 330 ppb 330 ppb 330 ppb 100 ppm 430 ppm 100 ppm 5 ppm 430 ppm
SD-57	Trichloroethene	Narrative*
SD-59	<i>Subsurface Soil:</i> TPH as Diesel TPH as Gasoline	10 ppm 1 ppm
SD-60	<i>Subsurface Soil:</i> Xylenes TPH as Gasoline	17 ppm 5* ppm
OT-62	<i>Surface Soil:</i> Cadmium Lead Zinc Benzo(k)fluoranthene Fluoranthene Naphthalene Pyrene TPH as Diesel <i>Subsurface Soil:</i> Benzo(a)pyrene TPH as Diesel	9 ppm 130 ppm 1559 ppm 330 ppb 330 ppb 330 ppb 330 ppb 10 ppm 330 ppb 10 ppm
SD-65	<i>Surface Soil:</i> Chromium Lead TPH as Diesel Oil and Grease <i>Subsurface Soil:</i> TPH as Diesel TPH as Gasoline	210 ppm 130 ppm 10 ppm 430 ppm 10 ppm 1 ppm
OT-69	<i>Surface Water:</i> Barium Manganese <i>Sediment:</i> Octachlorodibenzo-p-dioxin Octachlorodibenzofuran	1 ppm 100 ppb 5 Parts Per Trillion (ppt) total 2,3,7,8-TCDD

IRP Site Number	Contaminant(s) of Concern	Cleanup Standard
OT-69 (continued)	Total heptachlorodibenzo-p-dioxin Total heptachlorodibenzofuran Total hexachlorodibenzo-p-dioxin Total hexachlorodibenzofuran Total pentachlorodibenzo-p-dioxin Total pentachlorodibenzofuran Total tetrachlorodibenzofuran <i>Surface Soil:</i> Barium Zinc Octachlorodibenzo-p-dioxin Octachlorodibenzofuran Total heptachlorodibenzo-p-dioxin Total heptachlorodibenzofuran Total hexachlorodibenzo-p-dioxin Total hexachlorodibenzofuran Total pentachlorodibenzo-p-dioxin Total pentachlorodibenzofuran Total tetrachlorodibenzofuran	equivalent (TCDD= tetrachlorodibenzo-p-dioxin) 1754 ppm 1559 ppm 5 ppt total 2,3,7,8-TCDD equivalent (TCDD = tetrachlorodibenzo-p-dioxin)
SD-80	To be determined (TBD)	
SD-85	TBD	
OT-86	<i>Soil</i> Lead	130 ppm
OT-87	<i>Sediments:</i> Arsenic Lead <i>Surface Soil:</i> Lead Benzo(a)pyrene Benzo(g,h,i)perylene Dibenzo(a,h)anthracene Fluoranthene Phenanthrene	9.6 ppm 15.5 ppm (& pellet removal) 700 ppm 330 ppb 330 ppb 330 ppb 330 ppb 330 ppb
DD-88	TBD	
OT-89	TBD	
Main Base/SAC Plume	<i>Groundwater</i> PCE TCE 1,1-dichloroethene (DCE) cis-1,2-DCE 1,2-dichloroethane (DCA) carbon tetrachloride TPH as Diesel TPH as Gasoline Benzene Xylenes	5 ug/l 5 ug/l 6 ug/l 6 ug/l 0.5 ug/l 0.5 ug/l 100 ug/l 5 ug/l 1 ug/l 17 ug/l

Table 5: Cleanup Levels for Mather AFB IRP Sites (all cleanup levels are established by record of decision)		
IRP Site Number	Contaminant(s) of Concern	Cleanup Standard
Main Base/SAC Plume (continued)	Chloromethane Lead	3 ug/l 15 ug/l
Northeast Plume	<i>Groundwater</i> PCE Cis-1,2-DCE Carbon tetrachloride Chloromethane 1,2-DCP	5 ug/l 6 ug/l 0.5 ug/l 3 ug/l 5 ug/l
Site 7 Plume	<i>Groundwater</i> PCE TCE 1,1-dichloroethene (DCE) cis-1,2-DCE Vinyl chloride 1,2-dichloroethane (DCA) 1,4-Dichlorobenzene Benzene Chloromethane TPH as Diesel	5 ug/l 5 ug/l 6 ug/l 6 ug/l 0.5 ug/l 0.5 ug/l 5 ug/l 1 ug/l 3 ug/l 100 ug/l

Note: for explanation of narrative cleanup levels, see discussion of specific sites in Section 7

4.0 REMEDIAL ACTIONS

U.S. EPA guidance on the format for five-year review reports recommends that a section present information on remedy selection, implementation, and remedial system operation and maintenance. This review covers many sites, and therefore the information on remedial actions selected for each site, and discussion about implementation and operation and maintenance of the selected remedies is provided in Section 7 so the reader will not need to jump between sections to find the information about each site. This section provides a summary of the remedial decision documents.

There have been four records of decision (RODs) completed for Mather, covering five of the six operable units. The fifth record of decision, for the Supplemental Basewide Operable Unit 6 (OU-6), has been held up by dispute resolution to address State concerns over the management of institutional controls. Each of the operable units is listed below, in chronological order of the RODs, with a reference to the ROD, and a list of each the sites covered in that ROD, with a summary description of the remedy associated with that site. Only sites requiring remedial action under CERCLA are listed here. For a list of sites requiring no further action under CERCLA, see Table 1.

4.1 Operable Unit 1: Aircraft Control and Warning OU

The selected remedial actions are described in the Record of Decision for the Aircraft Control and Warning Site (AFBCA, 1993).

Site WP-12, the Aircraft Control and Warning Site, has a remedy of groundwater extraction treatment by air stripping. The treatment began in 1995. Treated water was initially reinjected to the aquifer, but has been discharged to Mather Lake since 1997 under authority of an Explanation of Significant Difference (AFBCA, 1997a).

Sites ST-25, ST- 20, and ST-47 were underground storage tank sites, for which the ROD required no further action (NFA)

4.2 Operable Unit 4: Landfill OU

The selected remedial actions are described in the Record of Decision for the Landfill Operable Unit (AFBCA, 1995)

Site LF-01 required no further action.

Site LF-02 was selected for capping, but then the waste was excavated and consolidated at Site LF-04 under removal authority and an Explanation of Significant Difference (AFBCA, 1996c; 1996e)

Site LF-03 was selected for capping, with long-term maintenance and monitoring

Site LF-04 was selected for incorporation of waste from other sites, then capping, with long-term maintenance and monitoring

Site LF-05 was selected for consolidation of waste into the Site LF-04 landfill, and groundwater monitoring
Site LF-06 was selected for consolidation of waste into the Site LF-04 landfill, and groundwater monitoring

4.3 Operable Unit 2: Groundwater OU, and OU 3: Soil OU

The selected remedial actions are described in the Record of Decision for the Soil Operable Unit Sites and the Groundwater Operable Unit Plumes (AFBCA, 1996b)

Groundwater OU (note that these groundwater plumes do not have site numbers)

The Main Base/Strategic Air Command Area Plume was selected for groundwater extraction treatment by air stripping, with reinjection of treated water.

The Site WP-07 Plume was selected for groundwater extraction treatment by air stripping, with reinjection of treated water.

The Northeast Plume was selected for long-term monitoring

In addition to these remedies, the ROD required the preparation of the Mather AFB Off-Base Water Supply Contingency Plan (AFBCA, 1998a)

Soil OU

Site WP-07/FT-11 was selected for in situ treatment of vadose-zone soils, in addition to the construction of a landfill cap over the former disposal pit at Site 7. Later, this remedy was augmented by allowing use of contaminated soil to build up the cap foundation under authority of an Explanation of Significant Difference (AFBCA, 1998c)

Site SD-13 was selected for excavation of contaminated sediments

Site SD-15 was selected for excavation of contaminated sediments

Site ST-20 (also addressed by the Basewide OU) was selected for excavation of contaminated sewer sludge

Site ST-37/ST-39/SS-54 was selected for in situ treatment of vadose-zone soils

Site SD-56 was selected for excavation of contaminated soil; this was later augmented by in situ treatment under authority of an Explanation of Significant Difference (AFBCA, 1998e)

Site SD-57 was selected for in situ treatment of vadose-zone soils

Site SD-59 was selected for excavation of contaminated soil; this was later augmented by in situ treatment under authority of an Explanation of Significant Difference (AFBCA, 1998e)

Site SD-60 was selected for excavation of contaminated soil; this was later augmented by in situ treatment under authority of an Explanation of Significant Difference (AFBCA, 1998e)

Site OT-62 was selected for excavation of contaminated soil

Site SD-65 was selected for excavation of contaminated soil

Site OT-69 was selected for excavation of contaminated soil and sediment. Soil from *Site OT-69* was allowed to be consolidated into the Site 4 landfill under authority of an Explanation of Significant Difference (AFBCA, 1996e)

4.4 Operable Unit 5, Basewide OU

The selected remedial actions are described in the Record of Decision for the Basewide Operable Unit (AFBCA, 1998b).

Site FT-IOCST-68 was selected for in situ treatment of vadose-zone soils. Earlier excavation of debris was accomplished under authority of a removal action memorandum (AFBCA, 1996d)

Site LF-18 was selected for in situ treatment of vadose-zone soils. The remediation of Site LF-18 has been conducted in conjunction with that of Site SD-59, using the same treatment unit.

Site ST-20 (also addressed by the Soil OU) was selected for excavation of contaminated surface soil, and groundwater monitoring.

Site OT-86 was selected for excavation of soil containing lead, recovery of particulate lead and stabilization of soil as necessary for disposal

Site OT-87 was selected for excavation of soil containing lead, recovery of particulate lead and stabilization of soil as necessary for disposal, and institutional controls

4.5 Operable Unit 6, Supplemental Basewide OU

The Supplemental Basewide Operable Unit ROD is not final as of this review; however, a summary description of the Basewide OU sites and removal actions accomplished at these sites is included here.

Site SD-80 has had excavation of contaminated sediments under removal action authority (AFBCA, 1999b; AFBCA 2001b). These activities are reported in two reports (Montgomery Watson, 2000b; MWH, 2002e)

Site SD-85 has had excavation of contaminated sediments under removal action authority (AFBCA, 1997b; AFBCA 2001b). These activities are reported in two reports (Montgomery Watson, 1999s; Montgomery Watson, 2002e)

Site DD-88 has had excavation of contaminated sediments under removal action authority (AFBCA, 1999a; AFBCA 2001b). These activities are reported in two reports (Montgomery Watson, 2000c; MWH, 2002e)

Site OT-89 has had some contaminated soil processed during a pilot test (Montgomery Watson, 2000a) and additional soil excavated under removal action authority (AFBCA, 2001b). The removal activity is reported in an informal technical information report (MWH, 2002b).

5.0 PROGRESS SINCE LAST REVIEW

U.S. EPA guidance on the format for five-year review reports recommends that a section describe progress since the last five-year review, including a description of the protectiveness statements from the last review, the status of recommendations from the last review, follow-up actions and results, and status of any other priority issues. This section was prepared following that guidance. The remedial progress of each site is addressed in Section 7.

5.1 Protectiveness Statement from Previous Review

The previous five-year review report (AFBCA, 1999c) is dated September 24, 1999. The document was signed by the Air Force, U.S. EPA, and California EPA and the report distributed with some revisions requested by the Central Valley Regional Water Quality Control Board (CVRWQCB), as well as the completed signature page, on February 8, 2000. The signatures were on the protectiveness statement, which read, *“Based on the information provided in this Five-Year Review Report, it is determined that the remedial actions selected and implemented for environmental contamination at sites at Mather AFB, and for groundwater contaminated by historical activities at Mather AFB, are functioning as designed, and are protective of human health and the environment. It is further determined that all necessary operations and maintenance are being performed.”*

5.2 Recommendations from Previous Review

There were two major concerns raised during the course of management of the CERCLA cleanup at Mather that were referred to the 1999 five-year review by the remedial project managers from AFRPA, U.S. EPA, the California DTSC and RWQCB. These are the sufficiency of institutional controls in the RODs for Mather, and the consideration of additional contaminants of potential concern at sites where soil vapor extraction is being conducted. Details of these concerns are expressed in comments from regulatory agency project managers, and Air Force response to those comments, in appendices A and B of the 1999 five-year review report (AFBCA, 1999c).

5.2.1 Institutional Controls

According to the 1999 review, *“There is a perceived lack of institutional controls required by Mather’s RODs for controlling potential exposure to groundwater contaminated at concentrations above the cleanup standards. The ROD for the Groundwater OU does incorporate institutional controls in the selected remedial actions for each of the Groundwater OU plumes, but the ROD contains no details of how the institutional controls are to be implemented. As discussed in Section 3.2, institutional controls are being implemented through Air Force ownership on Mather, and may soon be implemented by Sacramento County for the remainder of the areas impacted by Mather’s groundwater contamination. However, these controls are not required by the*

ROD for the AC&W OU. Although the contamination in the AC&W plume, if unremediated, represents an incremental lifetime cancer risk within the one-in-a-million and one-in-ten-thousand levels, the remedial project managers have agreed to amend the remedial action selected in the AC&W ROD to incorporate similar institutional controls as are required for the Groundwater OU.”

The Air Force committed to proposing an Explanation of Significant Difference (ESD) or ROD amendment schedule for the AC&W OU, subject to the RPMs’ decision and approval of a proposal under the FFA.

Such an amendment did not occur. There were discussions but not agreement among the RPMs on the institutional controls that would be implemented for the AC&W Plume. The Air Force offered to use the same institutional control wording as is in the Groundwater OU ROD. The issue has been superseded by lack of agreement on fundamental elements of implementation and monitoring, and enforcement of institutional controls. This is the focus of dispute resolution initiated by California EPA to prevent the Supplemental Basewide OU ROD from becoming final. The Air Force continues to prohibit activities that would interfere with the groundwater cleanup or that could result in exposure to contaminated water, through lease and deed restrictions, even though these prohibitions were not required as a part of the remedy selected in the 1993 ROD. In addition to the Air Force’s authority through the real estate documents, Sacramento County Code has been modified such that the permit for any well construction in or within 2000 feet of a known groundwater contamination plume requires a special review by appropriate regulatory agencies, to include the Central Valley Regional Water Quality Control Board. The resolution to the recommendation made in the 1999 five-year review is subject to the resolution of the dispute over the Supplemental Basewide OU ROD.

5.2.2 Additional Contaminants of Concern at SVE Sites

Sites WP-07/FT-11, ST-37/ST-39/ST-54, SD-56, SD-57, and SD-60 were selected for in situ treatment in decision documents for the Soil Operable Unit. Site FT-10C/ST-68 was selected for in situ treatment in the Record of Decision for the Basewide Operable Unit. The in situ treatment at each of these sites has been operated as a soil vapor extraction system (SVE). During SVE system monitoring, chemicals have been detected in addition to those identified as chemicals of concern in the decision documents.

In the last five-year review, the Air Force committed to treating these chemicals as potential contaminants of concern, and evaluating any continued presence of these chemicals as part of the decision to terminate SVE at any of these sites. This process is acceptable to the regulatory agencies, and has been successfully followed to achieve closure of Sites SD-56 and SD-60 since the 1999 five-year review.

5.3 Issues Raised During the 2003-2004 Five-Year Review

Three issues were raised by the regulatory remedial project managers (RPMs) during the current five-year review. The U.S. EPA requested consideration of the latest TCE risk estimates, and an evaluation of health risk to exposure from soil vapor contamination migrating into buildings. The U.S. EPA stated that there was not concern about migration of gas from the groundwater when the groundwater is more than 100 feet below the ground surface. U.S. EPA requested at the August BCT meeting that air stripper emissions be evaluated using the most recent Region IX preliminary remediation goal (PRG) risk factors. The Department of Toxic Substances Control (DTSC) requested that a state law authorizing DTSC to enter into land use covenants to implement and enforce institutional controls be evaluated as a change in standards. The RWQCB requested evaluation of revisions to state National Pollutant Discharge Elimination System (NPDES) permit requirements, in particular with respect to a NPDES permit issued for discharge to Mather Lake of treated water from the AC&W groundwater treatment plant, and requested that the AC&W treatment system effluent that discharges to Mather Lake be monitored for all the State Implementation Plan constituents of concern, and that the results be evaluated in the five-year review. The Air Force agreed to evaluate the State Implementation Plan monitoring requirements with respect to the AC&W discharge and the result will be a recommendation as to whether to monitor the constituents identified by the State Implementation Plan.

In addition to these three issues, there have been changes in the health risk associated with several of the contaminants of concern at Mather. The three issues raised by the regulatory agencies are discussed in this section; the changes in health risk estimates are addressed in Section 7.

5.3.1 Issues Identified by U.S. EPA

5.3.1.1 Consideration of the Latest TCE Risk Estimates

The latest TCE risk estimates refer to those using the slope factor promoted by U.S. EPA Region IX, which is in a draft assessment issued for public review by U.S. EPA in 2001 (U.S. EPA, 2001c). This slope factor for trichloroethene (TCE) represents a value used by EPA on a national level, but is not included in the Integrated Risk Information System (IRIS) database. The TCE slope factor was developed by the National Center for Environmental Assessment (NCEA). This slope factor was used by Region IX to develop the Region IX Preliminary Remediation Goals (PRGs), which were in turn considered and compared to risk factors promoted by the State and the prior factor used by U.S. EPA during this review to evaluate risk associated with groundwater contamination in Section 7.2.1. The TCE slope factor was also used to assess the risk from exposure to air stripper emissions in Section 5.3.1.3, and is incorporated into the OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils (Subsurface Vapor Intrusion Guidance) (U.S. EPA, 2002c).

5.3.1.2 Evaluation of Risk from Exposure to Soil Vapor Migrating into Buildings

The risk of exposure from soil vapor migrating into buildings was evaluated at sites with vadose-zone soil vapor, and at sites above water table contamination where there is not a vadose-zone source or an active soil vapor extraction system. At all sites with significant shallow soil gas, operating soil vapor extraction systems are preventing migration into indoor air, except during periods of rebound testing or system maintenance when the vacuum system is not operating. Some of the systems have been operated on schedules of 3 or 4 days per week, but this should be sufficient to overcome migration toward buildings that may have occurred during the intervening days. Site 23c, where deep soil gas was detected at relatively high concentrations (much above the screening levels in U.S. EPA draft guidance for evaluation of indoor air) and where no SVE system is in place, was also evaluated. Despite high soil gas concentrations at 71 feet below surface in boring SLB-MBR-43A (3000 parts per million by volume (ppmv) PCE, in 1996), the PCE concentrations dropped off to between 20 and 30 ppmv in three samples between 40 and 60 feet depth in the same borehole, and were not detected at 10 feet. In the 10-foot sample, TCE was detected at 13 ppmv, which exceeds the screening threshold in the draft U.S. EPA guidance. The guidance would recommend modeling if there were a building within 100 feet, however, the nearest building is about 125 feet away.

The water table concentrations from the Main Base/SAC Area Plume during second quarter 2003 (MWH, 2003h) were compared to the screening values in the Subsurface Vapor Intrusion Guidance (U.S. EPA, 2002c). One location barely exceeded the 13 ug/L screening level for carbon tetrachloride (MAFB-246 at 14 ug/L). This well is located over 400 feet from the nearest building. Two wells barely exceeded the 110 ug/L screening level for PCE (PZ-2 and EW5aBu, both at 120 ug/L). These wells are within the area where the vadose zone is treated by the Site 57 SVE system. Twenty five wells exceed the 5.3 ug/L initial screening level for TCE, based on the proposed TCE cancer slope factor of 0.4 per mg per kg-day (for comparison, the screening level using the TCE cancer slope factor promoted by the State would be 300 ug/L). Therefore, the Johnson-Ettinger (Johnson and Ettinger, 1991) model for migration of contaminants to indoor air was used. The latest version of the models in spreadsheet form downloaded from the U.S. EPA website:

http://www.epa.gov/superfund/programs/risk/airmodel/johnson_ettinger.htm.

This file includes both the screening model GW-SCREEN and the advanced model GW-ADV.

The screening model GW-SCREEN was used to estimate the groundwater concentration of TCE in Mather's Main Base/SAC Area Plume that the model predicts could exceed an acceptable risk (10^{-4} excess cancer risk) in indoor air in a building overlying the plume. The screening model assumes only one lithologic type in the vadose zone, so it was run using a range of lithologic types judged to be representative of the vadose zone. This model predicts that concentrations of TCE above about 60 ug/L could result in

unacceptable risk in indoor air overlying the plume. All but two of the wells with TCE concentrations above 60 ug/L are either locations within the Site 57 SVE system influence, or undeveloped areas. MAFB-99 (100 ug/L) and EW1ABu (240 ug/L) are both near aircraft hangars. The Johnson-Ettinger advanced model GW-ADV was applied, following a U.S. EPA user's guide (U.S. EPA, 2003), to simulate the vadose zone near these wells and to predict health risk from migration of TCE vapor at these locations into nearby buildings. Using this model and a water table concentration of 240 ug/L, an unacceptable health risk of 6.5×10^{-4} excess cancer risk was predicted. Although it is unlikely that the concentration in EW1ABu is representative of the concentrations under the nearby hangar, because the extraction well is drawing these high concentrations from the Site 57 area and keeps them from migrating further west to the hangar, empirical measurements are the best way of demonstrating whether there is measurable TCE migrating into the hangar building. As a result, this report recommends empirical testing to determine if measurable TCE vapor is shallow soil adjacent to the building. The modeling data is included in Appendix A to this report.

5.3.1.3 Calculation of Risk from Air Stripper Emissions Using Region IX Slope Factors

MWH calculated the risk from September 2003 air emissions for the Sacramento Metropolitan Air Quality Management District (SMAQMD)(MWH, 2003j). These are presented in tables 6 and 7 below for residential and commercial receptors with the risk calculated using the Region IX slope factors from the Region IX PRG tables at <http://www.epa.gov/region09/waste/sfund/prg/index.htm>.

The Site WP-07 air stripper system was not operating, but the emissions from the Site 7 stripper when operating are less than from the Main Base/SAC Area strippers. When the Site WP-07 air stripper comes back on line in mid 2004, it will most likely have a different combination of extraction wells than in the past. A risk assessment will be conducted based upon the actual emissions data, and the information transmitted to SMAQMD. This information will also be included in the groundwater monitoring report covering that time period.

The U.S. EPA Region IX slope factor for TCE results in an estimated risk from exposure to air emissions from the Main Base SAC Area air stripper, for commercial receptors, that just exceeds the one-in-a-million level. While this is within the acceptable risk range defined by 40 CFR 300, it is just above the threshold at which the SMAQMD normally requires (following guidance from the California Air Resources Board) best available control technology to be applied. The slope factor for TCE that is promoted by Region IX has not been adopted by U.S. EPA nationally. However, if this slope factor were to be adopted, the resulting risk calculation shows the risk to be very close to the threshold of concern, and would warrant an evaluation to determine if emissions control would be required under the ARARs for the remedial action.

Table 6: Main Base/SAC Area Air Stripper Emissions, September 2003

Residential Receptors					
Contami- nant	Dose mg/kg-day	Slope Factor (SMAQMD) 1/(mg/kg-day)	Risk (SMAQMD)	Slope Factor (Region IX) 1/(mg/kg-day)	Risk (Region IX)
PCE	5.2 E-06	0.021	1 E-07	0.01	5.2 E-08
TCE	2.2 E-06	0.007	2 E-08	0.4	8.8 E-07
CC14	2.3 E-07	0.15	4 E-08	0.053	1.2 E-08
Total			2 E-07		9.4 E-07
Commercial Receptors					
Contami- nant	Dose mg/kg-day	Slope Factor (SMAQMD) 1/(mg/kg-day)	Risk (SMAQMD)	Slope Factor (Region IX) 1/(mg/kg-day)	Risk (Region IX)
PCE	6.0 E-06	0.021	1 E-07	0.01	6.0 E-08
TCE	2.5 E-06	0.007	2 E-08	0.4	1.0 E-06
CC14	2.7 E-07	0.15	4 E-08	0.053	1.4 E-08
Total			2 E-07		1.07 E-06

Table 7 shows that the risks estimated for the AC&W air stripper are acceptable using either set of slope factors.

Table 7: AC&W Air Stripper Emissions, September 2003

Residential Receptors					
Contami- nant	Dose mg/kg-day	Slope Factor (SMAQMD) 1/(mg/kg-day)	Risk (SMAQMD)	Slope Factor (Region IX) 1/(mg/kg-day)	Risk (Region IX)
TCE	5.2 E-07	0.007	4 E-09	0.4	2.1 E-07
Commercial Receptors					
Contami- nant	Dose mg/kg-day	Slope Factor (SMAQMD) 1/(mg/kg-day)	Risk (SMAQMD)	Slope Factor (Region IX) 1/(mg/kg-day)	Risk (Region IX)
TCE	1.0 E-06	0.007	7 E-09	0.4	4.0 E-07

5.3.2 Issues Identified by DTSC

The California Department of Toxic Substances Control requested that 22 California Code of Regulations (CCR) Division 4.5, Chapter 39, section 67391.1, Requirements for Land Use Covenants, be considered as a possible applicable or relevant and appropriate requirement (ARAR) during this review. This regulation was adopted after the records of decision selected ARARs for the remedies for the first five operable units. Therefore, this review assesses whether the regulation changes a standard or otherwise causes any of the remedies to be considered not protective of human health and the environment. The AFRPA position is that Sections 67391.1 a, b, and d are relevant and appropriate only for new institutional controls to be implemented. The subject regulation provides for the state to enter into covenants to establish land use controls and to allow the state to enforce the controls. These controls and the associated enforcement authority augment the controls that are required as part of selected remedies and are currently in place, and the authority of the Air Force and U.S. EPA to enforce the controls. Therefore, they do not call into question the protectiveness of any of the remedies.

The Air Force considers section 67391.1, subsections (a), (b), and (d), potential ARARs for selection of remedial actions. The Air Force also recognizes the potential value of adding state enforcement authority to the existing Air Force and EPA authorities in those instances, as here, where the remedy in place is protective and there is no current legal requirement to take that action. Accordingly, the Air Force is willing to consider supplementing the records of decision that is the subject of this five-year review, through a memo for the site record, or other means, to implement the appropriate provisions of section 67391.1. The record of decision (ROD) for Site OT-89 has not yet been completed, and this regulation may be considered as an ARAR for Site OT-89 during the ongoing dispute resolution process that is addressing institutional controls for that ROD.

5.3.3 Issues Identified by RWQCB

The Central Valley Regional Water Quality Control Board (CVRWQCB, or RWQCB) requested evaluation of revisions to state National Pollutant Discharge Elimination System (NPDES) permit requirements, in particular with respect to a NPDES permit issued for discharge to Mather Lake of treated water from the AC&W groundwater treatment plant, and requested that the AC&W treatment system effluent that discharges to Mather Lake be monitored for all the State Implementation Plan constituents of concern, and that the results be evaluated in the five-year review. The Air Force agreed to evaluate the State Implementation Plan monitoring requirements with respect to the AC&W discharge and the result will be a recommendation as to whether to monitor the constituents identified by the State Implementation Plan.

The RWQCB and the Air Force do not agree on the regulatory status of the discharge to Mather Lake. The Air Force has determined that this discharge is an on-site activity, as defined under CERCLA, and therefore is exempt from permitting, instead being required to meet the substantive requirements of the regulation as of the date of the decision

document, and to review the protectiveness of the remedy during five-year reviews. This would result in modification of the remedy or ARARs if the remedy is found to be no longer protective of human health and the environment. The RWQCB issued a NPDES permit for this discharge in 1997. NPDES Permits are renewed after five years, at which time revisions to the regulation were be incorporated. However, the Air Force does not consider the permit applicable because of the CERCLA permit exemption.

The revisions include an expanded list of analytes that a discharger is required to monitor. However, the revisions do not change the cleanup standard nor the discharge standard for the groundwater contaminant of concern, TCE at the AC&W Site. The remedy is considered protective of human health and the environment. Therefore there is no need to amend the remedy to modify the ARARs.

6.0 FIVE-YEAR REVIEW PROCESS

The timing of this second five-year review is based upon the timing of the first review, and was agreed upon by the remedial project managers (RPMs) in a consensus statement (Remedial Project Managers, 2002). This was a change from the approach outlined in the FFA for Mather, which stated that a five-year review would be initiated by the remedial action for the last operable unit. In addition, this consensus statement corrected the date presented in the 1999 five-year review report, which indicated the next review would be due no later than June 29, 2003, when in fact five years from the due date for the 1999 review is June 29, 2004.

This five-year review is an update of the previous five-year review, but follows the revised U.S. EPA guidance as appropriate (U.S. EPA, 2001b).

6.1 Notification of Potentially Interested Parties of the Review

The initiation of the five-year review in 2003 has been briefed in both Base Realignment and Closure (BRAC) Cleanup Team (BCT) meetings and Mather Restoration Advisory Board (RAB) meetings every other month during the year. The planned due date of November 24, 2003 for the draft five-year review report was included on the Mather IRP Document Status schedules dated 6/10/03, 8/13/03, and 10/14/03; this document status is updated and handed out at both BCT and RAB meetings (AFRPA, 2003c, d, e, f, j, k).

6.2 Identification of Five-Year Review Team Members

This five-year review report has been authored, as was the previous five-year review report, by William T. Hughes, CSC, an Air Force contractor, based upon day-to-day on-site participation in the management of the environmental cleanup program at Mather, and associated communication with numerous Air Force, regulatory agency, and contractor staff, as well as members of the RAB and the public. Some of the key participants and their roles are listed here; however the list does not include all those who have contributed to this review process. Many of the roles listed here been filled by successive managers during the last five years; and many of these have support staff that have made significant contributions to project management or implementation; only the current managers are listed. Most of those listed will participate in review of this draft report, helping to improve the review and the final report.

Anthony C. Wong	Air Force Remedial Project Manager
Steve Hamilton	AFRPA Engineer
Paul Bernheisel	AFCEE Field Engineer
Linda Geissinger	AFRPA Public Affairs Manager
Carmen White	U.S. EPA Remedial Project Manager
Viola Cooper	U.S. EPA Community Involvement Coordinator
Tami Trearse	DTSC Remedial Project Manager
Lora Barrett	DTSC Public Participation Specialist

Karen Bessette	RWQCB Remedial Project Manager
Gino Yekta	IWMB Remedial Project Manager
Loni Adams	SMAQMD Associate Air Quality Specialist
Sandra Lunceford	Mather RAB Community Co-Chairperson
David Norris	Sacramento County Dept. of Economic Development
Keri Blaskoski	Sacramento County Dept. of Economic Development
Indira Balkissoon	TechLaw, contract support to U.S. EPA
John Scott	MWH, contract support manager
Kurt Condie	MWH, contract support manager
Todd Daniels	MWH, contract support manager

6.3 Components and Schedule of the Five-Year Review

This review was initiated in April 2003, with discussion at the April 9 - 10 BRAC Cleanup Team (BCT) meeting (AFRPA, 2003a). An action item was initiated for the regulatory remedial project managers (RPMs) from AFRPA, U.S. EPA, DTSC, and RWQCB, to identify and changes in risk standards that should be evaluated during the review. The current guidance from U.S. EPA (U.S. EPA 2001b), was reviewed, and a draft outline from the guidance was presented to the RPMs at the June 10-11 BCT meeting (AFRPA, 2003c).

The primary components of this review have been revisiting the previous review, reviewing the status of each site since the last review, evaluating the potential impact of new risk estimates for several contaminants of concern at Mather, and evaluating the potential risk through exposure to contaminants that could migrate in from soil gas into buildings. Document review was not conducted as a separate task, as the author (William T. Hughes, CSC) is familiar with the Mather documentation from long-term participation in the Mather program. Instead, documents were consulted during the technical review and reporting, and included in the reference list in Section 12 of this report.

6.4 Document Review, Data Review, and Evaluation

Document review was not conducted as a separate task, as the author is familiar with the Mather documentation from long-term participation in the Mather program. Instead, documents were consulted during the technical review and reporting, and included in the reference list in Section 12 of this report. Several areas of review required new data evaluation. A spreadsheet was compiled assessing the risk associated with the groundwater cleanup standards, using several sets of assumptions (see Section 7.1.2). Another spreadsheet was compiled of gas concentrations in vents and monitoring wells along the north side of Landfill Site 4, to confirm the effectiveness of the recommendations from the previous five-year review. A spreadsheet tabulating groundwater-sampling results for the Northeast Plume was updated to assess the overall patterns of monitoring data. Soil gas data and soil gas migration was evaluated to address the concern of risk posed by exposure to soil gas entering buildings (see Section 5.3.1.2).

6.5 Community Notification and Involvement

In addition to discussion in public RAB meetings (see Section 6.1), a notice announcing the availability of the draft report for public review has been submitted to the Grapevine Independent newspaper for publication on November 19, 2003. A further notification will be placed in the newspaper announcing the completion of the five-year review (i.e. issuance of the final report, signed by the parties to the Mather FFA). In a separate effort, interviews with members of the public were conducted in 2003 in support of a revision of the Mather Community Relations Plan (MWH, in progress).

6.6 Site Inspection

No separate site inspection was necessary to conduct this review. The author works at Mather and is familiar with the physical condition of the sites and remedial actions through frequent traverses of the facility.

6.7 Site Interviews

No formal interviews were necessary to determine site status. Interviews with members of the public were conducted in 2003 in support of a revision of the Mather Community Relations Plan (MWH, in progress). A summary of these interviews was reviewed (Appendix B), and some of the interviews were attended by the author (William T. Hughes, CSC). There were no relevant topics raised beyond those covered in this review.

7.0 TECHNICAL ASSESSMENT

The remedial actions selected for CERCLA cleanup at Mather are presented for each site, followed by an evaluation of the remedy at that site. The evaluation focuses on whether the remedial action functions as designed, whether the technologies used for cleanup are still effective, and whether the operation and maintenance is being performed adequately to avoid degradation of the remedial action. For each site, three questions are addressed:

- A. Is the remedy functioning as intended by the decision documents?
- B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?
- C. Has any other information come to light that could call into question the protectiveness of the remedy?

The first and third questions are addressed on a site-by-site basis in the subsections below. The second question is discussed first, because the same discussion applies to many of the site remedies, and then referenced in the site-specific text. This avoids much of the same text being repeated in the subsection for each site.

The cleanup standards for each site are presented in Table 5 for reference.

7.1 Question B Assessment of Assumptions

Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid? Each of these items is addressed in turn, followed by a discussion of changes and a general assessment, which is then referred to as appropriate in the site-specific subsections that follow.

7.1.1 Are the exposure assumptions used at the time of the remedy still valid?

The exposure assumptions used during the risk assessments for Mather were based upon current and anticipated future land use at each site. The exposure assumptions used at all sites were for residential use. An additional set of exposure assumptions were evaluated for some sites where industrial or recreational use was anticipated. Only Site 87 and the landfills have had remedies selected that are incompatible with unrestricted land use, and therefore have institutional controls as a part of the remedy. Site 89 is expected to have a similar remedy to Site 87, where some lead contamination will be left in soil. None of the exposure assumptions has changed or otherwise become invalid since the risk assessments and remedy selections. However, exposure to soil gas was not evaluated during the original risk assessments. Therefore it is addressed in this review, in Section 5.3.1.2.

7.1.2 Are the toxicity data used at the time of the remedy still valid?

Cleanup levels for groundwater were established as the contaminant-specific MCL where an MCL existed. EPA policy states that it will not reopen remedy selection decisions contained in RODs unless a new or modified requirement calls into question the protectiveness of the selected remedy. As noted in Section 7.1.3, none of the cleanup standards established for groundwater contaminants has been revised subsequent to the ROD. A review of Applicable or Relevant and Appropriate Requirements (ARARs) indicates that no new standards have been promulgated or proposed since the ROD that would call into question the protectiveness of the remedy for groundwater. However, the review did evaluate the cleanup levels with respect to the latest risk estimates supported by U.S. EPA and the State.

The numbers recommended for use in risk assessments have changed for many of the contaminants of concern at Mather since the risk assessments and remedy selections. The relationships between contaminant concentrations and health effects are quantified in cancer slope factors and hazard indices that represent estimates based upon the available toxicological data. These factors are combined with exposure assumptions to provide estimates of the risk of health effects that would result from the assumed exposure to a given concentration of a contaminant (or group of contaminants).

With the exception of lead, for which toxicity data has not changed, the basis for cleanup at all of the non-landfill sites covered in this review is based on the groundwater cleanup standards. The ongoing soil cleanup by soil vapor extraction and/or bioventing is based on protection of groundwater quality by removing sources in the soil that would otherwise prolong groundwater cleanup or render groundwater cleanup more expensive.

Therefore, the groundwater cleanup standards were reevaluated with the latest toxicity data. The primary source for toxicity data for a five-year review is the U.S. EPA Integrated Risk Information System (IRIS) database. However, the IRIS database is lacking oral toxicity data for several chemicals that are contaminants of concern for Mather. The IRIS data for the remaining contaminants of concern indicates no greater risk than the more stringent of risk estimates provided as either California Public Health Goals (PHGs), or the U.S. EPA Region IX Preliminary Remediation Goals (PRGs). The former are developed by the CalEPA office of Occupational and Environmental Health and Hazard Assessment, and assume 70-year exposure. The latter assume a 30-year exposure period.

The groundwater cleanup levels established for the groundwater remedies in the AC&W OU and the Groundwater OU, and relevant to the cleanup levels for soil and soil gas in the Soils OU and Basewide OU, were compared to the PHG and PRG values to evaluate whether the cleanup levels are still considered protective of human health. Table 6 lists each contaminant of concern, its cleanup level, and the incremental lifetime cancer risk (ILCR) estimated for that cleanup level using both the PRG and PHG risk assumptions. To evaluate protectiveness of the cleanup levels, the associated ILCR estimates are

compared to the acceptable risk range defined in the 40 CFR 300, the National Oil and Hazardous Substances Pollution Contingency Plan. The risk range in 40 CFR 300.430(e)(2)(i)(A)(2) is between 10^{-4} and 10^{-6} , which is equivalent to 100 per million to 1 per million. As can be seen in Table 8, almost all the risk estimates for the cleanup levels lie within or below this range. The risk associated with the cleanup level for trichloroethene (TCE) is estimated to be about 179 in a million using the U.S. EPA Region IX PRG assumptions, and about 6 in a million using the CalEPA PHG assumptions. The PRG-based estimate exceeds the acceptable range established by regulation. However, the estimate of risk varies greatly depending on the exposure assumptions and dose-response numbers used. The risk associated with the cleanup level for tetrachloroethene (also called perchloroethene, or PCE) is estimated to be about 8 in a million using the U.S. EPA Region IX PRG assumptions, and about 83 in a million using the CalEPA PHG assumptions. The cleanup levels for these two contaminants warrant concern, as one of the two risk estimates for each are relatively high.

Table 8: Risk Estimates for Groundwater Cleanup Levels using PRGs and PHGs

Contaminant of Concern	Cleanup Level	PRG	ILCR based on PRG	PHG	ILCR based on PHG
	ug/L	Ug/L	Per million		Per million
Benzene	1	0.34	2.9	0.15	6.7
Carbon tetrachloride	0.5	0.17	2.9	0.1	5.0
Chloromethane	3	1.5	2	n/a	
1,1-Dichloroethene	6	340	0.02	10	0.6
1,2-Dichloroethane	0.5	0.12	4.2	0.4	1.3
cis-1,2-Dichloroethene	6	61	0.1	n/a	
1,2-Dichloropropane	5	0.16	31	0.5	10.0
1,4-dichlorobenzene	5	0.5	10	6	0.8
Tetrachloroethene	5	0.66	7.6	0.06	83
Trichloroethene	5	0.028	180	0.8	6
Xylenes, total	17	210	0.08	1800	0.01
Vinyl Chloride	0.5	0.02	25	0.05	10

The other consideration when evaluating the risk associated with the cleanup level is that the plume consists of various mixtures of the contaminants of concern. When the cleanup levels are all met, there may still be mixtures of several contaminants at concentrations at or below the cleanup levels. The health risk of some or all of the contaminants in these mixtures may be additive, or in other words all contributing to the risk of cancer. At the time of the previous five-year review, a sum of the estimated risks associated with all the groundwater cleanup levels fell within the 40CFR 300 risk range, and it was therefore judged that the cleanup levels did not violate the regulation. The revised risk estimates, however, are such that using the PRG risk assumptions, TCE alone (at 179 in a million) exceeds the risk range and the sum of risk estimates for all the cleanup levels is about 265 in a million. Using the PHG risk assumptions, PCE contributes significantly to the sum of risks for all the cleanup levels exceeding the risk range, with about a 119 in a million cumulative risk. It is not known that the risks

actually are additive, but this assessment give the worst case additive estimate by assuming that the risk from all the contaminants would add up, and by assuming that concentrations in a hypothetical water sample consisted of all the contaminants of concern at the cleanup level concentrations, and that this was the sole drinking water source for the assumed exposure. Therefore this simple evaluation is not sufficient to show that the cleanup levels are protective.

A second, slightly more refined assessment was conducted as part of this review, in which the actual groundwater concentrations that could reasonable be expected at each monitoring location when cleanup levels are achieved were evaluated to see if these predicted contaminant concentrations were protective of human health. As would be expected, estimates based on the PRGs still exceed the 40CFR 300 risk range, because the risk estimated for TCE alone exceeds the risk range. However, the maximum values for additive risks, based on the predicted concentrations when cleanup levels are achieved at each monitoring well location, are below 189 in a million using the PRG estimates, of which TCE contributes about 179 in a million; and below 94 in a million, of which PCE contributes just over 83 in a million. These estimates are more refined, as they are based on the actual concentrations observed in monitoring data, but are also worst case, assuming that all risks are additive, that no remediation occurs near each well as soon as the cleanup levels are minimally achieved, and that these concentrations would persist and provide the sole source of drinking water for the assumed exposure.

The groundwater concentrations that could reasonably be expected at each monitoring location when cleanup levels were predicted for the latter assessment by inspecting the contaminant concentrations from second quarter 2003 at each well. Each contaminant concentration was divided by its cleanup level to determine the amount of reduction in contamination that would be required for the contaminant to reach its cleanup level. For instance, a PCE concentration of 50 ug/L, divided by its cleanup level of 5 ug/L, indicates that the concentration must be reduced ten fold. The highest such ratio was then applied to each concentration at the well, assuming that the same proportion of concentration reduction would be achieved for each contaminant. The resulting concentration predictions were used to calculate a risk and sum of risks for each well.

7.1.3 Are the cleanup levels used at the time of the remedy still valid?

The cleanup levels used at the time of the remedy selection are still valid. None of the bases for the cleanup levels have changed. These include the MCLs for most groundwater contaminants; secondary MCLs for petroleum hydrocarbons; and the suggested no adverse response level for chloromethane.

7.1.4 Are the remedial action objectives used at the time of the remedy still valid?

None of the remedial action objectives used at the time of remedy selection have changed, and all are still valid. The remedial action objectives are listed in the site-by-site discussions.

7.2. AC&W OU Selected Remedy and Remedial Objectives Evaluation

7.2.1 AC&W OU Selected Remedy

The remedial action selected in the AC&W ROD (USAF, 1993) was extraction of contaminated groundwater, treatment by air stripping, and discharge of treated water by reinjection into the aquifer horizon from which it was extracted. The pump and treat system began operating in January 1995 with eight extraction and eight injection wells, but was only able to consistently operate at about half of design capacity of 270 gallons per minute. This was because the injection well capacity could not be maintained at sufficient levels to discharge the design capacity. The remedial action was modified in 1997 to change the discharge from reinjection to discharge into Mather Lake, thereby allowing the system to operate at the design capacity. This decision was documented in the Final Explanation of Significant Difference (ESD)(AFBCA, 1997a).

7.2.2 AC&W OU Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1993) and the ESD (AFBCA, 1997a).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the remedy is still protective.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

The desirability of institutional controls has been discussed among the remedial project managers. Institutional controls are required for the Groundwater OU as necessary to prevent exposure to contaminated groundwater that could threaten human health. The previous five-year review determined that the risk posed by potential exposure to groundwater from the AC&W plume was within the acceptable range, but also documented that the remedial project managers had agreed to amend the remedy to include institutional controls similar to those required for the Groundwater OU. However the details were not subsequently agreed upon, and the method of implementation, monitoring, and enforcement of institutional controls has been in dispute since 2001.

Despite the fact that institutional controls are not required for the AC&W OU, land use controls are in place through leases and deeds that prohibit drilling wells in or near the AC&W Plume, and that prohibit interference with the cleanup. In addition, Sacramento County Code, Chapter 6.28, was modified in 2002 requiring review of all well permit applications for locations within 2000 feet of a contamination plume, by the CVRWQCB. This effectively provides another means of prohibiting wells that would either interfere with cleanup or result in unacceptable exposure to groundwater contaminants.

7.2.3 AC&W OU Remedial Objectives Evaluation

The objectives of the remedial action for the AC&W Site are to (1) achieve the cleanup standard of 5 micrograms per liter throughout the contaminated aquifer, and (2) comply with the discharge standards for disposing of the treated water. Progress continues to be made toward the first goal; it is too early to determine if the cleanup standard is economically achievable, but if model predictions are reasonably successful, the aquifer concentrations should approach the cleanup standard in about another decade. One near-source portion of the plume is sustaining higher than predicted concentrations, suggesting that this region may require additional time to attain cleanup, or that additional technologies to augment the current extraction system may be cost-effective to achieve cleanup.

The performance record for discharge has been flawed only by one early exceedance caused by a blower malfunction, and two unexplained detections of TCE in the effluent in 1996 (1.9 ug/l on 5/8/96 and 0.77 ug/l on 11/5/96). After the blower malfunction during the start-up phase, the control logic was immediately corrected so that the water pumps will shut down if the blower fails. However, even with the noted detections of TCE in the air stripper effluent, the system discharges have been in compliance with the requirements of the ROD, which for reinjection to the aquifer allowed daily excursions of no greater than 5 ug/l TCE provided that the monthly median was no greater than 0.5 ug/l TCE. In the cases when TCE was detected, the samples two weeks before and afterward had no TCE detected (i.e. <0.5 ug/l) and therefore the discharge standards for reinjection were consistently met. Discharge since 1997 has been to Mather Lake, as described below.

For the first two years of operation, the air stripper was treating only 45 to 60 percent (120 to 160 gpm) of the design capacity because the injection wells were unable to discharge more. As a result, the Air Force decided to change the discharge from reinjection to surface water discharge. The decision was documented in the Explanation of Significant Difference to the AC&W OU Record of Decision, Discharge of Treated Groundwater to Mather Lake (AFBCA, 1997a). This allowed the system to treat about 250 gpm. Discharge to the lake has occurred since June 1997 and has met all discharge standards (Montgomery Watson, 1999w, 2003e, 3003g). Since June 1997 the system has been operating in the range of 170 to 270 gpm (about 180 gpm in 2003). The influent

concentration has dropped from about 130 micrograms per liter (ug/l) during 1995 to about 60 ug/l during 1998, to about 20 ug/L in 2003. During late 1999, 2000 and 2001, , the discharge was reduced in increments and well EW-5 was shut off, to mitigate possible dewatering of the aquifer, until TCE was detected at PZ-5, indicating that some TCE was escaping capture (see Figure 2 for well locations). EW-5 was then brought back on line and discharge from EW-4 was increased to ensure capture. Concentrations in PZ-5 have persisted, but concentrations peaked at 2.3 ug/L in the third quarter of 2001, and have been below 2 ug/L since the second quarter of 2002. Figure 3 shows well locations, and a comparison of the 2003 plume configuration to the baseline plume configuration.

AFBCA issued a report of proper and successful operation [a.k.a. Operating Properly and Successfully (OPS)] for the AC&W remedial action (AFBCA, 1998d) which received concurrence from U.S. EPA in November 1998 (U.S. EPA, 1998). The OPS report documents that the remedial action is operating as designed, and is successfully remediating the contamination at the site. Based upon system performance to date, the remedial action is expected to require at least another five years to attain the aquifer cleanup standard, and consequently will require another five-year policy review when the next five-year review for Mather is accomplished.

The remedial action is being maintained in accordance with the Operation and Maintenance Manual for the AC&W (EA, 1995, and Montgomery Watson, 1997e). In 1998 well AT-1 was added as an eighth extraction well to replace AT-3, shut off in 1996 after the aquifer cleanup standard was achieved in its vicinity. When the pump from AT-3 was transferred to AT-1, the discharge pipe was replaced, as it had experienced some apparent corrosion. Also in 1998, the pump discharge pipe in well AT-2 was replaced after its extraction rate was noticed to degrade. It was discovered to have developed holes, apparently caused by galvanic reaction between the black (ductile) iron casing and the stainless steel well screens. As a result of this experience, all the pumps were inspected and the casings replaced in 1999. Well EW-6 was replaced by well EW6R in 1999 after a hole was discovered in the well screen of EW-6 in late 1998. Operation was interrupted for several weeks in the third quarter 2002 after the utility lines were damaged during roadway construction on Arnold Way.

The performance monitoring of the AC&W remedial action has documented continued success at TCE removal from the aquifer and at meeting discharge standards for the treated groundwater. This demonstrates that the extraction and treatment technologies continue to be effective. The concentrations in most of the extraction wells are tracking well with model predictions, which indicate the cleanup will be completed in about 10 years in these portions of the plume. Concentrations at extraction well AT-1, however, have been persisting at about 30 ug/l, and this may indicate a persistent contribution of TCE to the aquifer from either the vadose zone, or a source in the saturated zone. One approach to address this persistent source is to use carbon substrate addition to promote biodegradation of the TCE. However, the source area must be delineated (i.e. vadose zone and/or saturated zone) and a conceptual model of its mass and flux to the groundwater must be refined before the costs and durations of cleanup by this approach or other alternatives can be compared to the current system cost. It is recommended that

the persistence of the apparent source area be evaluated and a plan of action be proposed in the annual 2003 groundwater monitoring report.

7.3 Groundwater OU Selected Remedies and Remedial Objectives Evaluation

7.3.1 Main Base/SAC Industrial Area Plume Remedial Action

The remedial action selected in the ROD for the Main Base/SAC Industrial Area Plume is a pump and treat program with the following components:

- A phased implementation program;
- A groundwater extraction, to achieve aquifer cleanup standards, estimated but not limited to a total rate of 1,300 gallons per minute (gpm);
- Treatment of the extracted groundwater through air stripping with off-gas treatment (i.e. carbon adsorption) to achieve aquifer cleanup standards (see Table 5) and to achieve discharge standards (for treated water and off-gas);
- Groundwater injection in compliance with discharge standards; in combination with other discharge options (to be evaluated during remedial design) that are (a) consistent with attainment of cleanup standards, and (b) cost-effective;
- Land-use restrictions will be implemented on USAF property as appropriate, in order to preclude installation of groundwater wells that would not be compatible with protection of public health and the environment; and
- Monitoring the groundwater.

In addition, the ROD required the development of a Mather-specific off-base water supply contingency plan, which applies to contaminants from the Main Base/SAC Plume. This plan was finalized in February 1998, and contains requirements for additional sampling of off-base water supply wells near the Main Base/SAC Industrial Area Plume, and for response actions when any contaminants of concern are detected in a supply well at half the cleanup level.

7.3.1.1 Main Base/SAC Industrial Area Plume Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1996b), although the remedy construction has not been completed. The installation of at least one more extraction well and a system performance evaluation are planned for 2004 and 2005.

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1).

C. Has any other information come to light that could call into question the protectiveness of the remedy?

The U.S. EPA, DISC, and RWQCB have all expressed concern that the first four phases of the extraction system have not resulted in full capture of the Main Base/SAC Industrial Area Plume. This issue is currently among the concerns undergoing dispute resolution between the regulatory agencies and the Air Force in association with the revision in 2000 of the Mather AFB Off-Base Water Supply Contingency Plan. The revised plan will not be finalized until the dispute is resolved. However, the regulatory agencies and the Air Force continue to work together to identify the additional extraction well or wells needed to complete the extraction system to satisfy the ROD (AFBCA, 1996b). In the meantime the Air Force maintains protectiveness by providing well-head treatment on affected drinking water supply wells (see Section 7.3.1.3). A second topic of concern is the potential commingling of perchlorate from known upgradient sources or other unknown sources. The cleanup of perchlorate from known upgradient sources is occurring through two programs, one under U.S. EPA and RWQCB regulatory authority, and the other under RWQCB an DTSC regulatory authority. Low concentrations of perchlorate have also been detected in all the Main Base/SAC Area extraction wells in 2004, in a pattern that is not compatible with a specific source area. The concentrations have not exceeded 2 ug/L in this recent sampling, and the situation continues to be evaluated.

7.3.1.2 Main Base/SAC Industrial Area Plume Remedial Objectives Evaluation

The objectives of the remedial action for the Main Base/SAC Industrial Area Plume are to (1) achieve the cleanup levels throughout the contaminated aquifer, and (2) comply with the discharge standards for disposing of the treated water. In addition, the remedial action calls for land-use restrictions on USAF property as appropriate, and groundwater monitoring. The Mather AFB Off-Base Water Supply Contingency Plan (Contingency Plan; AFBCA, 1998a) embodies the objective of preventing water at any drinking water supply well from exceeding the drinking water standard through proactive intervention.

The phased construction of the remedial action is underway; the first phase including the treatment plant and injection wells, was constructed, and began treating water from 'hot spots' on Mather in April 1998. 'Hot spots' are defined as portions of the plume where contaminants are at concentrations at least ten times the cleanup level for that contaminant. Phases II and III were constructed concurrent with the previous five-year review, and became operational in 2000. A combined design report for the two phases was issued in September 1999 (Montgomery Watson, 1999v). Phase II extends the groundwater extraction system off base, and Phase III augments the Phase I system to expand the extent of capture and enhance the capture of 'hot spots' of groundwater contamination. Phase IV was constructed in 2001 (Montgomery Watson, 2001p) and 2002, and became operational in 2002.

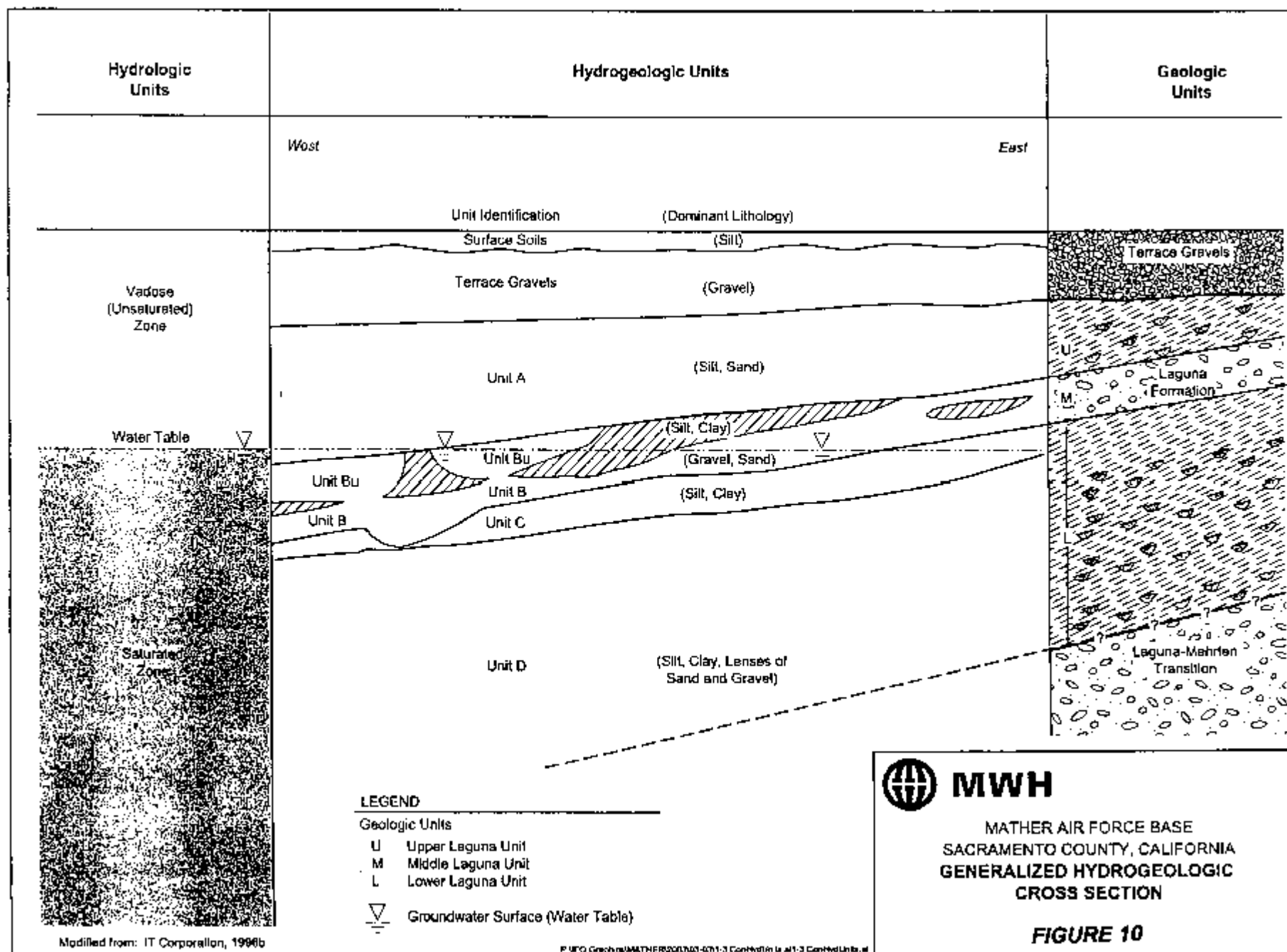
Figure 2 depicts the overall plume extent and the location of wells. Figures 4, 5, and 6 show more detailed information about the water table; hydrostratigraphic units B upper (Bu) and B; and hydrostratigraphic Unit D, respectively. The relationship of the hydrostratigraphic layers is schematically shown in Figure 10. These figures were taken from the draft 2003 annual groundwater monitoring report (MWH, 2004a), and there may be revisions to these figures in the final report based upon comments received on the draft report. On figures 4, 5, and 6, the extent of capture is shown, and the plume is colored to show concentrations above 0.5 ug/L, above cleanup levels, and above ten times cleanup levels. Inspection of Figure 4 reveals an area in the southwestern part of the water table plume that is beyond the capture of EW-1 Bu (note however that the potentiometric surface shows that the capture extends at least several hundred feet further southwest than the dotted line indicates). The fate of the uncaptured contamination in this area is likely for the contamination to migrate downward into the Bu and or B zones. EW-3Bu may be activated if necessary to control further migration in the Bu.

Inspection of Figure 5 reveals two major areas that remain beyond the capture of extraction wells. The first is near EW-3Bu, but also exists in the B zone. If necessary, EW-3Bu may be deepened to influence the B zone in addition to the Bu zone. The second area is between the Juvenile Hall wells and the Moonbeam Drive well. This is where new extraction well EW-12B is planned for installation in 2004.

Inspection of Figure 6 reveals that the portion of the contaminant plume that is not captured by Mather's extraction wells is captured by the Moonbeam Drive well. The Moonbeam Drive well operates with granular activated carbon treatment, and has operated with influent concentrations of about 0.35 ug/L each of PCE and carbon tetrachloride.

At least one additional phase will be necessary to augment the off-base portion of the extraction system in order to achieve the ROD objective of achieving the cleanup levels throughout the contaminated aquifer.. An evaluation of the remedy performance was scheduled for 2004, but has been delayed until 2005 so that the funds earmarked for assessment of the remedy and design of Phase V design can be used to install a new extraction well (EW-12B) near monitoring well MAFB-331, in the vicinity of the Juvenile Hall wells and the Moonbeam Drive well. The performance assessment in 2005 will focus on any portions of the plume not captured by the extraction system, the projected fate of these portions of the plume, and options for addressing these parts of the plume.

Progress toward objective (1) is consistent with the remedial action selected in the ROD. As of June 2003, , 1880 pounds of PCE and 496 pounds of TCE had been removed from the groundwater (MWH, 2003h). The removal rates were about a pound per day of PCE and 0.3 pounds per day of TCE in June 2003. The remedial action remains protective during extraction system build-out by continuing to limit exposure by providing well-head treatment on supply wells as required by the Mather Off-base Water Supply Contingency Plan (AFBCA, 1998a) (see Section 7.3.1.3 et seq.).



A list of extraction and injection wells associated with each phase of construction is provided in Table 9. The letter designations indicate the screen depth in one or more of the progressively deeper aquifer units A, Bu, B, and D. More detail about well construction and lithology can be found in reports on each of the phases (Montgomery Watson, 1999d and 2000n; and MWH, 2003b).

Table 9: Well Installation for Main Base/SAC Area Plume Remediation		
Phase	Wells	Year Installed
I	EW-1A, -2A, -3A EW-1Bu, -2Bu, -3Bu EW-1B, -2B EW-2D IW-501, -502, -503	1997
II/III	EW-4A, -5A EW-1A/Bu, -2A/Bu, -4A/Bu, -5A/Bu, -6A/Bu EW-39A/Bu/B EW-3B, -4B, -5B, -6B, -8B IW-504	1999
IV	EW-4Bu EW-12A/B EW-9B, -10B, -11B EW-4D, -5D, -6D	2002

The effluent from the treatment plant has consistently been non-detect for contaminants of concern since start-up, except for one estimated detection of 10 ug/L TPH-g, which was estimated because it was below the laboratory reporting limit on 5/11/98, as documented in the Third Quarter 1998 Basewide Groundwater Monitoring Report (Montgomery Watson, 1998m) and the Annual and 4th Quarter 1998 Groundwater Monitoring Report (Montgomery Watson, 1999t). However, the discharge standard for TPH-g is 50 ug/L, so the standard was not exceeded. Thus, the effluent has been in compliance with the discharge standards continuously since the treatment plant started operating.

Land-use restrictions prohibiting or requiring approval for any groundwater well construction on USAF property have been implemented through direct Air Force control prior to property transfer, and through conditions of lease and transfer agreements for all property overlying Groundwater Operable Unit contamination. No land-use restrictions have been systematically applied for off-base property. However, the County of Sacramento adopted a revised County Code Chapter 6.28., This ordinance governs drilling of wells to incorporate a 'consultation zone' within 2000 feet of any known groundwater contamination. Any permit application to drill or modify a well in this zone requires consultation with the RWQCB prior to issuing any well permits. This. revised

ordinance allows recommendations to the County regarding their permitting choices: to approve, approve with conditions, or deny approval for each permit application.

Groundwater monitoring continues as part of the Groundwater Monitoring Program that includes routine monitoring and performance monitoring for the groundwater remedial actions. The monitoring program is governed by decision logic presented annually in the groundwater monitoring program evaluation reports (i.e. MWH, 2004b). The decision logic has been improved through the years in an effort to enhance the cost-effectiveness of the monitoring program. In addition to the logic governing sampling frequency, changes have been made to sampling method, such as changing from conventional purging to micropurging, and then to passive diffusion bag sampling for volatile organic contaminants, and the use of shorter lists of analytes where appropriate.

In addition to the routine monitoring of Mather's plumes, monitoring is also occurring to address a second topic of concern, the potential commingling of perchlorate from known upgradient sources or other unknown sources. Perchlorate contamination has migrated beneath portions of the Northeast Plume and the Main Base/SAC Area Plume, and another migration route has carried perchlorate near the AC&W Plume at a depth that would bring it just beneath the Mather AC&W TCE plume. To date, sampling has not indicated any commingling. The cleanup of perchlorate from known upgradient sources is occurring through two programs, one under U.S. EPA and RWQCB regulatory authority, and the other under RWQCB and DTSC regulatory authority. Low concentrations of perchlorate have also been detected in all the Main Base/SAC Area extraction wells in 2004, in a pattern that is not compatible with a specific source area, and does not appear to be related to the deeper perchlorate plume from upgradient sources. The concentrations have not exceeded 2 ug/L in this recent sampling, and the situation continues to be evaluated.

The technologies of groundwater extraction, air stripping, and reinjection have been demonstrated to be effective at remediating groundwater contamination. However, the experience at Mather's AC&W Site where reinjection capacity degraded and limited the effectiveness of the remedial action has served as a lesson learned to AFBCA. This experience was carefully considered during the design of the Main Base/SAC reinjection wells. The reinjection was planned in more transmissive aquifer zones, and excess capacity was constructed to allow for possible capacity losses over time. To date, only one of the four injection wells for the Main Base/SAC Area treatment system has been underperforming its design capacity. However, this has not compromised the remedial action as excess injection capacity was incorporated into the design to accommodate such an event. The effectiveness of these technologies will be monitored and documented as part of the annual reporting for the Main Base groundwater remediation.

7.3.1.3 Affected Water Supply Wells: Off-base Water Supply Contingency Plan

The ROD also contained a requirement for the Air Force to develop a Mather-specific off-base Water Supply Contingency Plan in consultation with the State, U.S. EPA, and

local water agencies: When the ROD was signed in 1996, the Main Base/SAC Industrial Area Groundwater Plume had reached at least one municipal water supply well beyond the base boundary and had the potential to reach other wells beyond the base boundary. Since then, contaminants have been detected at four other supply wells. The levels of contaminant constituents in the affected wells have generally been below the maximum contaminant level (MCL) safe drinking water standards promulgated by U.S. EPA and the State. However, the potential risks represented by the detected concentrations have increased as new cancer slope factors have been adopted by state agencies, as discussed below.

The USAF developed a Mather-specific off-base Water Supply Contingency Plan (AFBCA, 1998a) in consultation with the State, U.S. EPA, and local water agencies, as required by the ROD. The plan addresses the human health threat posed by the Plume to affected water supply wells and wells that may be affected in the future due to plume migration. The Water Supply Contingency Plan was subject to public review and comment.

The Contingency Plan was required to address the following for each affected well or potentially affected well:

- (1) Determine which wells will likely be affected;
- (2) Provide an ongoing monitoring plan of supply wells and their guard wells, including increased frequency of sampling once a constituent from the Plume has been detected;
- (3) Determine the impact of supply well pumping on the plume and recommend action(s) to minimize plume migration;
- (4) Evaluate the short term and long-term options for providing alternate water supplies (the evaluation shall consider the technical effectiveness in dealing with the health threat, implementation time frame, cost, and acceptability to the water purveyor);
- (5) Propose a preferred alternative, including an implementation time schedule, which should address the sequencing of alternate remedies if the final solution is to include short-term and long-term solutions);
- (6) Develop a trigger for ascertaining when an option(s) should be implemented;
- (7) Propose measures and an implementation schedule to mitigate the vertical migration of contaminants to deeper aquifer zones for each well likely to be impacted by the plume; and
- (8) Determine when the monitoring plan can be terminated.

The conditions for triggering the provision of alternate water supply were the subject of dispute resolution among the Air Force, U.S. EPA, and the State of California. The resulting settlement decision established that one half the maximum contaminant level for PCE, TCE, or carbon tetrachloride would be the concentration to trigger initiation of wellhead treatment at a well. However, the State disagreed that this trigger was appropriate for PCE, and the settlement also allows any party to reopen the dispute if PCE concentrations are of concern in any supply well or guard well (AFBCA, 1998a).

A revision to the plan was undertaken in 1999 and 2000, to reflect changes such as the destruction of the water supply well on Explorer Drive and the transfer of the water system at Mather Air Force Base to Sacramento County. The revised plan was disputed by the State in 2000 and the dispute has not been resolved as of this review. The 1998 plan is therefore still in effect.

7.3.1.4 Mather Off-base Water Supply Contingency Plan — Remedial Action Objectives Analysis

The objectives of the Contingency Plan were to evaluate the effect of supply wells on contaminant migration, establish action levels for implementing response actions of water treatment or alternate water supply, to assess the options for response actions, and to recommend appropriate response actions.

Ten drinking water supply wells were identified as of concern, and a monitoring plan developed that also includes nearby monitoring wells. The Plan concludes that plume migration and vertical migration are best addressed through the extraction and treatment of contaminated water per the remedial action for the Main Base/SAC Area Plume. The Plan indicates that once contamination reaches a supply well such that concentrations in the well exceed or will exceed one half the maximum contaminant level, the Air Force will provide well-head treatment for that well. Wellhead treatment can be terminated once concentrations of all contaminants are below one half the maximum contaminant level for six months. Monitoring may be terminated after a year of no detections in a supply well (below 0.5 ug/L for PCE and TCE, and below 0.2 ug/L for carbon tetrachloride).

Two carbon adsorption treatment systems have been installed for off-base water supply wells, consistent with the Contingency Plan, at the well on Moonbeam Drive owned by Citizens Utilities Company of California, and at the Sacramento County water system on Branch Center Drive supplied by the two Juvenile Hall wells (See Figure 2 for well locations). Influent concentrations for both systems have remained at concentrations that require treatment of alternate water supply under the Contingency Plan. The effluent from both treatment systems has continued to contain no detected contaminants of concern (Montgomery Watson, 1998b, 1999v, 2000f, 2001 a, 2002d, 20002k, MWH, 2003a).

The Mars Way well has not been operated for drinking water supply since 1997; when the well owner, Citizens Utilities Company of California (now California American

Water Company) took the well off line after a reported detection of TCE. Detections of PCE and TCE have been persistent since then at concentrations below a part per billion.

Low concentrations of TCE have also been reported in the Gould Way well starting in 2002. However, the source of this contamination does not appear to be any known part of the Mather plumes. The upper perforations in the Gould Way well are between 158 and 162 feet below ground surface, which could be the lower Unit B or the upper Unit D. Figures 5 and 6 show the relationship of the Gould Way well to the plumes in each of these horizons. The plume closest to the Gould Way well contains PCE but no TCE. Concentrations have been less than 0.2 parts per billion (the drinking water standard is 5 parts per billion, and the Contingency Plan would require treatment or replacement water at 2.5 ug/L).

7.3.2 Site 7 Groundwater Plume Remedial Action

The remedial action selected in the ROD for the Site 7 Plume is a pump and treat program with the following components:

- Groundwater extraction at a rate of approximately 250 gpm;
- Treatment of the extracted groundwater through air stripping with off-gas treatment (i.e. carbon adsorption) to achieve aquifer cleanup standards (see Table 5) and to achieve discharge standard (for treated water and off-gas);
- Groundwater injection in compliance with discharge standards; in combination with other discharge options (to be evaluated during remedial design) that are (a) consistent with attainment of cleanup standards, and (b) cost-effective;
- Land-use restrictions will be implemented on USAF property as appropriate, in order to preclude installation of groundwater wells that would not be compatible with protection of public health and the environment; and
- Monitoring the groundwater.

7.3.2.1 Site 7 Groundwater Plume Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy has been functioning as intended by the ROD (AFBCA, 1996b). However, the operation of the remedy has been interrupted three times by aggregate mining and reclamation activities by the two landowners on whose property the extraction wells are located.

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the remedy is still protective.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

While the interruptions have been of concern and have delayed the progress of the remedial action, they have not compromised the protectiveness. The plume extent has not measurably changed during the last five years. Current plans are for the extraction and monitoring systems to be restored in 2004, after which operation and performance monitoring will resume.

7.3.2.2 Site 7 Groundwater Plume Remedial Objectives Evaluation

The objectives of the remedial action for the Site 7 Plume are to (1) achieve the cleanup standards throughout the contaminated aquifer, and (2) comply with the discharge standards for disposing of the treated water.

When the construction of the remedial action was planned; the mining of the property overlying the plume necessitated a staged approach to implementing the Site 7 Groundwater plume remedial action. The treatment plant was constructed in 1998, and began operating to treat groundwater from one existing extraction well in December 1998. This operation was disrupted in July 1999 while mining occurred in the area of this extraction well. The extraction system was restored in April 2001 with an extraction well near the toe of the plume, in an area represented as protected from mining for several years. This turned out to be incorrect, and operation was interrupted once more in July 2001, until the system could be restored and resume operation in March 2002 with a new extraction well near the original one. Finally, the system operation was interrupted in April 2003 while an aqueduct was constructed between the extraction well and the treatment plant. Current plans are for the extraction and monitoring systems to be restored in 2004, after which operation and performance monitoring will resume with two extraction wells.

The effluent from the treatment plant has not exceeded the detection limit for contaminants of concern, although the extracted and treated water have greater concentrations of some general minerals parameters than the baseline concentrations measured in the receiving water. General minerals (referring to alkalinity, bicarbonate, carbonate, chloride, fluoride, hardness, nitrate, sulfate, sulfide, and total dissolved solids) are monitored quarterly, as the indicated in the Operations and Maintenance Manual for the Groundwater Extraction and Treatment System for Site 7 Plume (Montgomery Watson, 1999e). The current easement contains a clause that makes the treated water available to Teichert Aggregate Company for dust control, thereby potentially reducing the amount of treated water that is injected. This clause has not been invoked to date because of the logistics of delivering the water across Morrison Creek and the interruption of treatment operation.

The technologies of groundwater extraction, air stripping, and reinjection have been demonstrated to be effective at remediating groundwater contamination. However, the

experience at Mather's AC&W Site, where reinjection capacity degraded and limited the effectiveness of the remedial action, has served as a lesson learned to AFBCA. This experience was carefully considered during the design of the Site 7 reinjection wells. The reinjection was planned in more transmissive aquifer zones, and excess capacity was constructed to allow for possible capacity losses over time. The effectiveness of these technologies will be monitored and documented as part of the annual reporting for the Site 7 groundwater remediation.

7.3.3 Northeast Groundwater Plume Remedial Action

The ROD determined that active remediation of the Northeast Groundwater Plume was not warranted in 1995 because action was being taken to remediate the source (Landfill Site LF-04), and because removing the low-concentration contaminants from the groundwater would provide little benefit while incurring high costs. The remedial action selected contains the following components:

- Institutional controls (such as deed restrictions) are required to prohibit the installation of groundwater supply wells on Mather AFB that would jeopardize public health or the environment from the Northeast Groundwater Plume area. If off-base groundwater wells are proposed or constructed that could result in exposure to contaminated groundwater from the Northeast Plume, the need for active cleanup or other action must be revisited. Contaminant concentration levels in the groundwater will be re-evaluated annually. If the contamination concentrations drop below the levels in Table 5 for one year, any institutional controls may be removed.
- Long-term groundwater monitoring will be continued and modified as necessary to monitor contaminant concentrations. Monitoring will be conducted pursuant to Title 23, CCR, Section 2550.10 (Corrective Action Monitoring) for at least one year from the date that the cleanup standards (see Table 5) are attained. After that time, monitoring will, as required by the Landfill ROD, be conducted pursuant to Title 23, CCR, Section 2550.8 (Detection Monitoring), in order to detect potential future releases from Landfill Site LF-04.
- Prior to the first CERCLA five-year review, additional predictive modeling will be conducted in order to assess whether the contaminants will meet the levels in Table 5 within a reasonable time. The results of that modeling will be published in an appropriate document or an Explanation of Significant Difference (ESD), if necessary. If, at any time monitoring or modeling indicates that the contaminants will not meet the levels in Table 5 within a reasonable time, or at least forty years from the date of the ROD, or that significant migration of the contaminants may occur at levels above those in Table 5 which impacts public health or the environment, active remediation will be reconsidered.

7.3.3.1 Northeast Groundwater Plume Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1996b).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but none of the numerical standards used to establish cleanup levels have changed since they were cited in the ROD; and the changes in toxicity data do not result in the cleanup standards exceeding the National Contingency Plan acceptable risk range. Therefore, the cleanup levels are still considered protective of human health and the environment

C. Has any other information come to light that could call into question the protectiveness of the remedy?

There has been no information that has indicated the remedy is not protective. The regulatory agencies have expressed concern that there has not been satisfactory demonstrable progress toward the achievement of aquifer cleanup levels. The area of the plume exceeding the cleanup levels has decreased, but there has not until recently been a clear trend in the wells with the highest concentrations that indicates when aquifer cleanup levels might be reached. Well MAFB-132 does not yet exhibit a convincing downward trend; and the screened interval in this well was changed in June 2003 to accommodate the decline in water table elevation. Therefore more monitoring data is required to determine whether the pattern evident up to June 2003 continues in the sample data from the lower screened interval.

7.3.3.2 Northeast Groundwater Plume Remedial Action Analysis

The remedial action objectives for the Northeast Plume are to protect the public from inadvertent significant exposure to contaminated groundwater by implementing institutional controls, to perform long-term monitoring to maintain an awareness of conditions in the plume and any predictable changes in these conditions, and to reassess the remedial decision if cleanup standards are predicted to require more than forty years to attain.

No land-use restrictions have been systematically applied for off-base property. However, the County of Sacramento adopted a revised County Code Chapter 6.28 to incorporate a 'consultation zone' within 2000 feet of any known groundwater contamination that would require consultation with the Regional Water Quality Control Board (RWQCB) prior to issuing any well permits. The RWQCB makes

recommendations to the County regarding their permitting choices: to approve, approve with conditions, or deny approval for each permit application.

Institutional controls are in place on Mather via continued Air Force ownership of most of the property overlying the Northeast Plume. These controls are intended to prevent significant exposure to contaminated groundwater from occurring (i.e. limiting new wells or requiring testing if water is intended for human consumption and treatment if groundwater contamination is detected at significant concentrations). The property overlying most of the Northeast Plume is still owned by the Air Force, and leased to the County. There are institutional controls within the lease (Lease Agreement between the Department of the Air Force and the Sacramento County Mather Conversion Authority for Mather Air Force Base, California, executed 21 March, 1995, conditions 10.13, 17.3, 24.1, and 24.2) that prohibit drilling on the leased property without written permission from the Air Force. Condition 20 requires that these requirements bind any sublessee also. Therefore institutional controls are in effect on Air Force property to further ensure that the chance of exposure is minimized, but are not stipulated in the ROD.

A portion of the Northeast Plume extends beyond the boundaries of Air Force ownership. However, the potentiometric gradient interpreted from the wells on Mather indicates that groundwater flows from the north toward this boundary, so the extent of the plume to the north beyond the former base is not likely to be great unless there are off-base contaminant sources, as there is in at least one case monitored by well MAFB-109 (see Figure 2 for well locations). Additional monitoring wells are planned for installation to the north once land development brings access roads to facilitate access. Sacramento County requires permits for any well installation or alteration; any permit application for a well within 2000 feet of the Northeast Plume must be reviewed by the CVRWQCB; therefore if any wells were proposed beyond Air Force property, these would be addressed through the permitting process.

Mather Groundwater monitoring has occurred in wells throughout the area of the Northeast Plume for eight years since the ROD was issued. Only two of the five COCs have exceeded cleanup standards in this time. Historically, a total of sixteen different wells have had at least one sample where either PCE or cis-1,2-DCE (or both) has exceeded cleanup standards. One well exceeded the cleanup standard for carbon tetrachloride, and one well exceeded the cleanup standard for 1,2 dichloropropane (1,2-DCP). Since the issuance of the ROD, only eight wells have exceeded the cleanup standards.

The extent of the Northeast Plume has not changed radically in this time, but the portion of the plume above the cleanup levels has decreased. The interpreted extent of the plume in second quarter 1998 (Montgomery Watson, 1998h), was compared with the interpreted extent of the plume in second quarter 2003 (MWH, 2003h). Some additional monitoring wells have been installed since 1998 that have increased the known downgradient extent. There is uncertainty about the extent north of Mather, and this contributed to a larger plume extent in the 1998 interpretation, but the comparison shows that the area of the

plume where contaminant concentrations exceed the cleanup levels has decreased markedly over the last five years.

Table 10: Northeast Plume Area		
	Second Quarter 1998	Second Quarter 2003
Total Acreage	635	531
Acreage Above Cleanup Levels	128	40
Percentage of Plume Area Above Cleanup Levels	20%	7.5%

The northern limit is not yet defined adequately for purposes of remediation, although based upon the southerly gradient at the water table near the Northeast Plume that has persisted at least through the 1990's, contamination from sources at Mather (i.e. Landfill sites 3 and 4) is not expected to have migrated very far to the north. Additional monitoring wells are planned for installation to the north in 2005 once land development brings access roads to facilitate access.

A visual comparison of the fourth quarter 2003 plume contours to the baseline contours is presented in Figure 7 for PCE and Figure 8 for cis-1,2-DCE. The baseline contours are based on the average concentrations from the ten quarters of monitoring that immediately preceded the issuance of the ROD for the Groundwater OU. These figures are from the draft 2003 annual groundwater monitoring report (MWH, 2004a). It is evident that the extent of the plume with concentrations above the cleanup level for PCE has diminished considerably for PCE since the start of the remedial action in 1996. It also appears that the downgradient extent of both PCE and cis-1,2-DCE has increased by several thousand feet. It should be noted however, that all the wells in this area with the exception of MAFB-276 were installed after the baseline extent was interpreted. MAFB-276 has detections of PCE and cis-1,2-DCE in 1994, but as the baseline extent was based on averages, MAFB-276 was shown as outside the plume extent in the baseline interpretation.

Figures 8 and 9 display time-concentration plots for selected wells. It is noteworthy that the wells which have had the highest concentrations of PCE and cis-1,2-DCE, MAFB-132, -133, and -136, show decreases in concentration for both contaminants over the last two years or more. The possible exception to this pattern is for cis-1,2-DCE in MAFB-132, for which the pattern is not as convincing. It is important to note, however, that MAFB-132 and MAFB-136 were altered in June 2003. MAFB-132 and -136, as well as MAFB-141, were constructed with two screened intervals separated by a packer. In June 2003, the water levels had dropped below the upper screens and the packers were removed. Therefore data since June 2003 represents samples collected from a deeper screen in each of these wells. Therefore an additional period of monitoring will be required to ascertain whether data from the lower screens in these wells show a discernable trend.

This apparent downward trend is an important pattern, because if it persists, it will support predictions of further concentration decrease and eventual achievement of aquifer

cleanup levels. At the time of the Northeast Plume Evaluation Report (AFBCA, 2002a) no such clear indication was present. Three of the four wells with significant history of, concentrations above cleanup levels have shown a longer-term decreasing trend (MAFB-130, -133, -136). However, MAFB-132 has had increasing concentrations until fourth quarter 2002. The landfill caps at sites LF-03 and LF-04 have been in place since 1996; but it appears that the apparent changes in Northeast Plume concentrations as a result of the landfill capping may require more years of monitoring to confirm.

The monitoring well network appears to be adequately distributed throughout the plume area, with the exception of the northern boundary. The contaminant plume is fully defined where it exceeds cleanup standards except for the northern boundary of contamination that extends beyond Air Force property. Several of the water table wells monitoring the Northeast Plume have gone dry as water levels have dropped over the course of the last five years. MAFB-26 had detections of PCE at about the MCL when it went dry; it was replaced by MAFB-398, which has similar detected concentrations. MAFB-132, -136, and -141 were constructed with two screened intervals separated by a packer. In June 2003, the water levels had dropped below the upper screens and the packers were removed. Therefore data since June 2003 represents samples collected from a deeper screen in each of these wells. There have been several replacement water table wells and three deeper wells installed to determine the depth of the plume. Deeper wells MAFB-398C, -399, and -400 have detections of PCE and cis-1,2 DCE below the cleanup standards.

The ROD commitment to perform modeling prior to the first five-year review, to predict how much time will be required for the contaminant concentrations to fall below the cleanup standards, was not accomplished for that review. An evaluation of the Northeast Plume was conducted in 2001 – 2002 (AFBCA, 2002a) Inspection of the wells with contaminant detections reveals that the concentrations exhibited sporadic patterns that did not allow confident predictions of future concentrations. The report recommended to continue monitoring the Northeast plume as opposed to initiating active remediation, and recommend a similar evaluation be conducted periodically as monitoring data warrants, but no less frequently than the five-year reviews.

Predictive modeling may now be viable based upon the evident decreasing contaminant concentration trends. The forecast will be dominated by predictions based upon results from well MAFB-132, which is now the only well with concentrations significantly above the cleanup levels. However, as the screened interval monitored in this well was changed in June 2003, modeling predictions based upon historic data can not be validated for the depth sampled for that historic data.

Inspection of the evident trends of decreasing concentrations and decreasing plume extent above the aquifer cleanup levels reveals that the plume area that still exceeds the cleanup levels appears to be collapsing to the area of MAFB-132, immediately adjacent to LF-04. Based on the information available at the time of this review, it appears that the contaminant concentrations outside of the area around MAFB-132 will meet the

cleanup levels within a reasonable time. Additional monitoring data will help to clarify the nature and persistence of patterns in MAFB-132. The more persistent a trend, the more confidence it allows in data projections. Changes and trends in the Northeast Plume monitoring results will be evaluated in each Annual Basewide Groundwater Monitoring Report. It is recommended that the annual reports each year provided such a projection for wells with concentrations above the cleanup levels, or an assessment that the data indicates a pattern insufficient for a projection.

7.3.4 Groundwater OU Performance Evaluations

In addition to operational monitoring of influent and air emissions, the ROD requires that routine sampling of the groundwater will be conducted to monitor the migration of the contaminated plumes and decreases in the concentrations. This data is to be utilized to evaluate the need for institutional controls as well as to periodically evaluate the performance of the remedial system.

The U.S. EPA recommends an initial evaluation to be conducted one to two years after the remedy is operational and functional, in order to determine whether modifications to the restoration action are necessary. The U.S. EPA also recommends that more extensive performance evaluations be conducted at least every five years [55 Federal Register (FR) 8740]. The purpose of the evaluations is to determine whether cleanup levels have been, or will be, achieved in the desired time frame. After the evaluations are completed, the following options should be considered:

- Discontinue operations;
- Upgrade or replace the remedial action to achieve the original remedial action objectives or modified remedial action objectives; and/or
- Modify the remedial action objectives and continue remediation, if appropriate [55 FR 8740].

7.3.4.1 Performance Evaluations Remedial Objective Analysis

The performance of the remedial actions for the Groundwater OU plumes is evaluated in the annual groundwater monitoring reports. Groundwater monitoring has been ongoing on a regular basis since the first quarter of 1990, and continues with performance monitoring (Montgomery Watson, 2003e) considered in selection of monitoring well locations and sampling frequency (i.e., Montgomery Watson, 1998q). The remedial action for the Main Base/SAC treatment plant began operating in April 1998, and the Site 7 treatment plant began operating in December 1998. At both sites, potentiometric effects of extraction and concentration reductions attributable to the groundwater extraction systems have been observed. Neither system, however, is fully operational and functional, as both extraction systems have not been completed. The potentiometric

and concentration data collected from each operating phase has been incorporated into the design for ensuing phases of extraction system construction (i.e. Montgomery Watson, 1999w, 2001m). A system optimization study is under way currently for the Main Base/SAC Area extraction system, and a performance evaluation of this system is planned for 2004 (the evaluation may be deferred until 2005 in order to install an additional extraction well in 2004). A performance evaluation is planned for the Site 7 groundwater remediation system in 2005, based on the restoration of the system to resume operating in 2004.

7.4 Soils OU: Selected Remedies and Remedial Objectives Evaluation

7.4.1 Site WP-07/FT-11

7.4.1.1 Site 7/11 - “7100 Area” Disposal Site/Existing Fire Protection Training Area - Selected Remedial Action

The remedial action for Site 7/11 has been selected in the ROD and modified by an Explanation of Significant Differences (AFBCA, 1998c). The major components of this remedy include (ESD modifications shown in *italics*):

- Filling in the depression at Site 7 with inert fill *or soils meeting acceptance criteria in the ESD*
- Treating the contaminated shallow and deep soils at Sites 7 and 11 by in situ bioremediation and possibly soil vapor extraction (SVE). The in situ bioremediation system could be converted to a SVE system if significant amounts of solvents are encountered, in order to speed up remediation;
- Installing a prescriptive landfill cover over the Site 7 impacted area [*the ESD deletes the following ROD condition, “if site conditions indicates it is appropriate, or a vegetative cover if there is no threat to groundwater quality nor generation of landfill gases,”*] using inert soils and/or non-designated soils to construct the foundation for the cap/cover; and
- Monitoring the groundwater (if contamination remains in place that threatens groundwater quality).

According to the ROD and ESD, remediation at Site 7/11 was to be implemented in a phased approach, whereby SVE, bioventing, and soil gas monitoring would be implemented prior to *construction of the* [*the ESD deletes the following ROD condition, “a final determination on the need for a”*] prescription landfill cover pursuant to Article 8 of 23 California Code of Regulations (CCR), Division 3, Chapter 15. Once the SVE/bioventing system has been operated until it has met cleanup standards, or design goals as appropriate, or has otherwise reached technical or economic limitations, a determination will be made whether a continuing source of methane or trace gases exist, and whether a significant threat to groundwater quality exists.

The Air Force conducted further soil gas sampling at this site to define the extent of volatile organic compound (VOC) contamination, as part of the remedial design work, and determined that SVE was feasible based on an interpretation of soil gas data.

The ROD contains the following SVE initiation text that applies to Site 7/11, Site 37/39/54, and Site 57:

The actual decision on whether to build and operate an SVE system will depend on the degree to which the contamination presents a threat to ground water and whether site characteristics are suitable for the SVE technology. It is generally preferable from a technical and cost perspective to clean up contamination in the vadose zone before it reaches the ground water. The feasibility analysis will be prepared by the Air Force as a primary document. The decision will be made by the signatory parties to the FFA and will be based, at a minimum, on the following factors:

- a. The cost and time associated with the predicted additional groundwater remediation if no SVE is implemented;
- b. The cost of implementing the SVE system to meet the SVE soil cleanup standard;
- c. The incremental cost over time of vadose zone remediation compared to the incremental cost of groundwater remediation, on the basis of a common unit (e.g., cost to remove a pound of TCE), provided that the underlying groundwater has not reached aquifer cleanup levels;
- d. The results of VLEACH or another appropriate vadose zone model, in conjunction with a groundwater fate and transport model to predict the resulting concentration from the vadose zone contamination in the nearest groundwater wells monitoring the site;
- e. The results of VLEACH or another appropriate vadose zone model, that interprets soilgas data, to predict the mass and concentration of discharges from the vadose zone to the groundwater;

This demonstration is to be made prior to operation of the bioventing system in areas considered for SVE (to prevent interference from bioventing). Once SVE is initiated, it will be terminated in accordance with the demonstration required for Site 57 (ROD Section 2.2.9.7). The need to implement the bioventing remedy will be reevaluated when SVE is terminated.

The ROD also contains the following SVE shut-off criteria that apply to sites 7/11, 37/39/54, and 57.

The goal of cleaning up the vadose zone is to minimize further degradation of the groundwater by the contaminants in the soil. It is generally preferable from a technical and cost perspective to clean up contamination in the vadose zone before it reaches the groundwater. The soil cleanup standard will be achieved when the residual vadose zone contaminants will not cause the groundwater cleanup standard, as measured in groundwater wells monitoring the plume, to be exceeded after the cessation of the groundwater remediation. The Air Force will make the demonstration that the standard has been met through contaminant fate and transport modeling, trend analysis, mass balance, and/or other means. This demonstration will include examination of the effects of the residual vadose zone contamination in the groundwater using VLEACH or another appropriate vadose zone model, in conjunction with a groundwater fate and transport model, to predict the resulting concentration from this residual vadose zone contamination in the nearest groundwater wells monitoring the site. This demonstration can be made prior to the cessation of groundwater remediation. The Air Force shall provide verification, through actual data, that the above standard has been met. The signatory parties to this Record of Decision (ROD) will jointly make the decision that the soil cleanup standard has been met.

The Air Force shall operate the SVE system until it makes the demonstration that the cleanup standard, set forth above, has been met. The Air Force shall continue to operate the SVE system if appropriate, after considering the following factors:

- a) Whether the predicted concentration of the leachate from the vadose zone (using VLEACH or another appropriate vadose zone model that interprets soil gas data) will exceed the groundwater cleanup standard;
- b) Whether the mass removal rate is approaching asymptotic levels after temporary shutdown periods and appropriate optimization of the SVE system;
- c) The additional cost of continuing to operate the SVE system at concentrations approaching asymptotic mass levels;
- d) The predicted effectiveness and cost of further enhancements to the SVE system (e.g., additional vapor extraction wells);
- e) Whether the cost of groundwater remediation will be significantly more if the residual vadose zone contamination is not addressed;

(continued)

- f) Whether residual mass in the vadose zone will significantly prolong the time to attain the ground water cleanup standard; and
- g) The incremental cost over time of vadose zone remediation compared to the incremental cost over time for groundwater remediation on the basis of a common unit (e.g., cost of pound of TCE removed) provided that the underlying groundwater has not reached aquifer cleanup levels.

The signatory parties agree that the Air Force may cycle the SVE system on and off in order to optimize the SVE operation and/or to evaluate the factors listed above.

The signatory parties to this ROD will jointly make the decision that the SVE system may be shut off. If the parties cannot reach a joint resolution, any party may invoke dispute resolution. This ROD does not resolve the ARAR status of State requirements regarding the establishment of soil cleanup levels. The parties agree that in the event of a dispute regarding SVE shutoff, the State may argue its authority to require soil cleanup (including soil cleanup standards) as the basis for continuing operation of the SVE system, based on the above factors.

Initial site grading was accomplished in conjunction with drilling in order to allow site access for the drill rigs. Some SVE/biovent wells were installed in trenches that were excavated to evaluate perched water in the depression. The cap was constructed with SVE/biovent wells in place to treat the vadose zone under the cap.

7.4.1.2 Site 7/11 - Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1996b) and the ESD (AFBCA, 1998c).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the remedy is still protective. The site closure process agreed to by the remedial project managers (Montgomery Watson, 2002c) for SVE remedies includes a determination that the site poses no unacceptable health risk. This ensures that any changes in exposure assumptions or toxicity data are incorporated into the remedial action. Site 7 has very little gas generation, as the amount of organic

debris in the pit is much less than at municipal landfill sites, and there is also relatively little generation of non-methane gas species.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that calls into question the protectiveness of the remedy.

7.4.1.3 Site WP-07/FT-11 - Remedial Action Evaluation

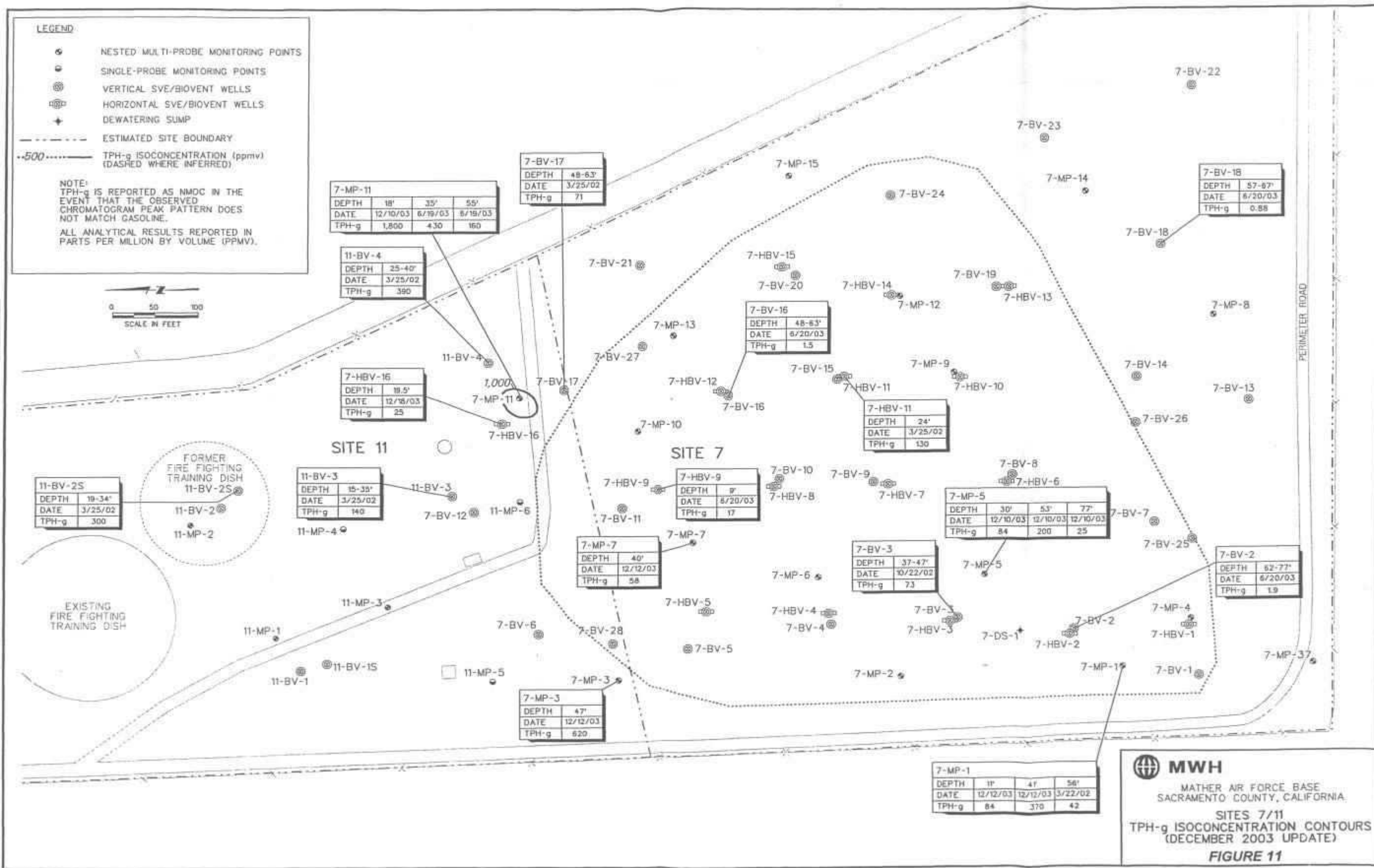
The remedial objectives for Site WP-07/FT-11 are to achieve cleanup standards for the COCs, to mitigate any residual source of groundwater contamination that may be present, and to comply with ARARs for the Site WP-07 solid waste disposal site.

The depression at Site SP-07 has been filled with soil from other IRP sites to create positive drainage away from the disposal site, and a landfill cap constructed at the site. In situ treatment and monitoring wells have been installed both within the former waste disposal pit at Site SP-07 and in the surrounding areas of TPH-d contamination at Site 7/11. Two SVE treatment units were installed at the site. One began operation in November 1998 extracting and thermally treating vapor from Site FT-11. The second began operating in December 1998 extracting and thermally treating vapor from Site WP-07. The Site FT-11 treatment unit removed about 91,000 pounds of reactive organic contaminants before the extraction system was connected to the Site WP-07 unit. During SVE, oxygen levels at Site FT-11 have maintained concentrations above 10%, indicating that oxygen is being replenished to assist biodegradation. The Site WP-07 unit had removed about 83,000 pounds as of June 2003 (MWH, 20030. During the course of operating these systems, several adjustments have been made to enhance effectiveness and efficiency. In the third quarter 2002, a new horizontal extraction well was installed near the hot spot at monitoring point 7-MP-11. Figure 11 shows the well locations and influence of the extraction wells at Site WP-07. Some wells were opened to the atmosphere to promote circulation of oxygen through areas of petroleum contamination. Starting in 2000, the Site WP-07 unit was cycled weekly with 3 or 4 days on and 3 or 4 days off. During the first half of 2003, the unit extracted 52 to 118 pounds of contaminants per day during the operating days. The cleanup now focuses on hot spots that remain at 7-MP-5 and 7-MP-11. The SVE/bioventing system continues to remove contaminants, and continues to make progress toward fulfilling the remedial action objectives. The general plan for the system is to continue operating until TPH-g concentrations are below 2500 ppmv, at which time the system may be operated in bioventing mode to promote biodegradation of the petroleum contamination.

The radius of influence of the soil vapor extraction system is depicted in a figure in the latest semiannual monitoring report, here reproduced as Figure 12 (Figures 2-7 in MWH, 20030 and the extent appears more than sufficient to encompass the remaining contamination at both Site WP-07 and Site FT-11.

DATE: 2/2/04

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MWH
MATHER AIR FORCE BASE
SACRAMENTO COUNTY, CALIFORNIA
SITES 7/11
TPH-g ISOCONCENTRATION CONTOURS
(DECEMBER 2003 UPDATE)
FIGURE 11

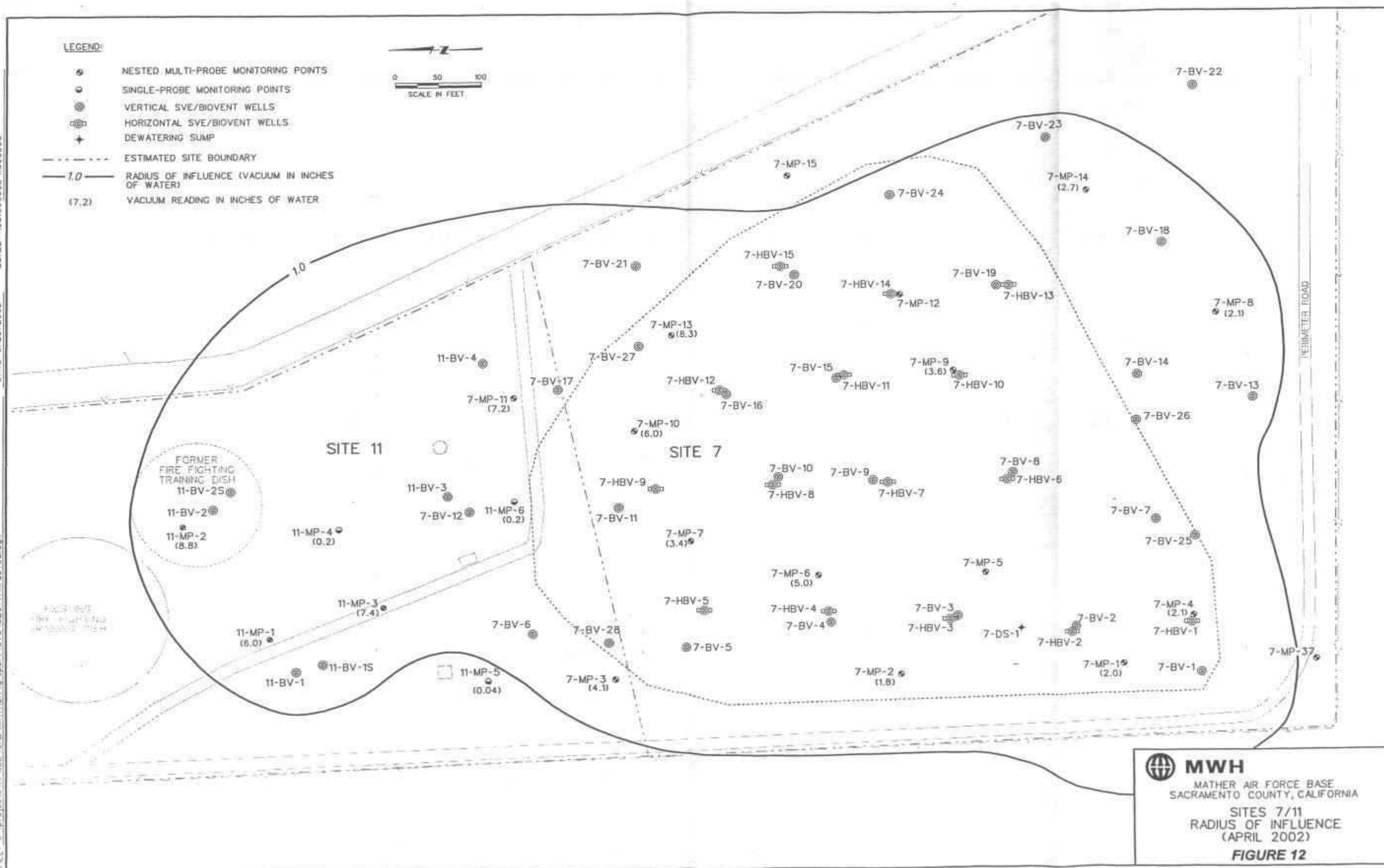
SCALE: 100.0000001.000000

DATE: 8/25/2003

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LEGEND:

- NESTED MULTI-PROBE MONITORING POINTS
- SINGLE-PROBE MONITORING POINTS
- ⊙ VERTICAL SVE/BIOVENT WELLS
- ⊗ HORIZONTAL SVE/BIOVENT WELLS
- ⊕ DEWATERING SUMP
- - - ESTIMATED SITE BOUNDARY
- 1.0 RADIUS OF INFLUENCE (VACUUM IN INCHES OF WATER)
- (7.2) VACUUM READING IN INCHES OF WATER



MWH
 MATHER AIR FORCE BASE
 SACRAMENTO COUNTY, CALIFORNIA
 SITES 7/11
 RADIUS OF INFLUENCE
 (APRIL 2002)
FIGURE 12

In addition to vapor-phase contamination, dissolved-phase contamination is present in perched water at about 60 feet below ground surface. The Air Force plans to remove water from this perched zone in 2004 to evaluate the feasibility of removing contamination by flushing or dewatering the zone.

The landfill cap construction is documented in the Final Closure Certification Report for Site 7 (Montgomery Watson, 2000g) and is being maintained and monitored in accordance with the Final Closure and Post-Closure Maintenance Plan for the Engineered Cap at Remedial Action Site 7 (Montgomery Watson, 1999q) and the Final Addendum to the Final Basewide Groundwater Monitoring Sampling and Analysis Plan for Landfill Gas Monitoring – Revision 1 (Montgomery Watson, 2000d). As of November 2003, the cap had not experienced any significant erosion or deterioration, and landfill gas had not been detected at concentrations of concern.

Based on the performance to date, the Soil OU remedy for Site WP-07/FT-1 1 is considered protective.

7.4.2 Site ST-37/ST-39/SS-54 - Building 3389/Hazardous Waste Control Storage Area

7.4.2.1 Site ST-37/ST-39/SS-54 - Building 3389/Hazardous Waste Control Storage – Selected Remedial Action

The remedial action for Site ST-37/ST-39/SS-54 includes these major components:

- Excavating approximately 220 yd³ of contaminated surface soils to remove all contamination above acceptable levels;
- Transporting the excavated soils to the on-base ex situ bioremediation facility;
- Treating the excavated soils by ex situ bioremediation as appropriate;
- Transporting the treated soils to, and consolidating them with landfill cap foundation materials at Site WP-07, as appropriate;
- Treating the contaminated shallow and deep soils by in situ bioremediation and possible SVE. The in situ bioremediation system could be converted if appropriate, to an SVE system if significant amounts of solvents are encountered in order to speed up remediation; and
- Monitoring the groundwater if contamination that threatens groundwater quality remains at the site.

The Air Force will conduct further soil gas sampling at this site to define the extent of VOC contamination, as part of the remedial design work. The feasibility of SVE will be

evaluated when it is demonstrated that soil contaminants may cause concentrations in the leachate to exceed the aquifer cleanup levels, based on an interpretation of soil gas data using VLEACH or another appropriate vadose zone model.

The ROD also contains conditions for initiating and terminating SVE remediation at Site ST-37/ST-39/SS-54 (See text box, Section 3.3.1.1).

7.4.2.2 Site ST-37/ST-39/SS-54 - Building 3389/Hazardous Waste Storage —Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1996b).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the remedy is still protective. The site closure process (Montgomery Watson, 2002c) agreed to by the remedial project managers for SVE remedies includes a determination that the site poses no unacceptable health risk. This ensures that any changes in exposure assumptions or toxicity data are incorporated into the remedial action.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that calls into question the protectiveness of the remedy.

7.4.2.3 Site ST-37/ST-39/SS-54 - Building 3389/Hazardous Waste Storage —Remedial Objectives Evaluation

The remedial objectives for Site ST-37/ST-39/SS-54 are to achieve cleanup standards for the COCs, and to mitigate any potential or residual source of groundwater contamination that may be present

An in situ treatment system of extraction/injection and monitoring wells and a soil vapor extraction unit was installed at Site ST-37/ST-39/SS-54 in 1998, and began full-time operation in 1999. The system had began operating 4 days per week in 2000 to reduce the fuel burned for thermal treatment, and 3 days per week in 2003. In March 2001, extraction wells from non-CERCLA sites ST-29/ST-71 and ST-35/ST-36 were connected to the SVE treatment system at Sites ST-37/ST-39/SS-54 in order to achieve more efficient treatment for all these sites. This reduced the number of operating thermal treatment units from three to one for these seven sites. As of June 2003, the treatment system at Site ST-37/ST-39/SS-54 had removed about 260,000 pounds of

contaminants, and was extracting up to 45 pounds per day when actively extracting. Concentrations of TPH-g at Site ST-37ST-139/SS-54 have decreased significantly at the site over the 4 ½ -year period since system startup. The maximum concentration in June 2003 was 15,000 ppmv TPH-g, compared with 720,000 ppmv in 1998, at monitoring point 37-MPMP-04. There is also a hot spot of benzene at 37-MPMP-08 (290 ppmv in June 2003). The general plan for the system is to continue operating until TPH-g concentrations are below 2500 ppmv, at which time the system may be operated in bioventing mode to promote biodegradation of the petroleum contamination.

The radius of influence of the soil vapor extraction system in each of three depth intervals is depicted in the Informal Technical Information Report for Remedial Actions at Sites 37, 39, and 54 (Montgomery Watson, 2000c). The influence of the extraction system appears to be adequate to address the vadose-zone contamination associated with these sites, as well as contamination associated with portions of Site OT-23 (identified as 23b and 23d in the ROD, AFBCA 1998).

Based on the performance to date, the Soil OU remedy for Site ST-37ST-/39/SS-54 is considered protective.

7.4.3 Site SD-56 - Oil/Water Separator 2989

714.3.1 Site SD-56 - Oil/Water Separator 2989: Remedial Action

The remedial action selected for Site SD-56 included the following major components:

- Excavating approximately 1,110 yd³ of contaminated surface and shallow soils to remove all contamination above acceptable levels;
- Transporting the excavated soils to the on-base ex situ bioremediation facility;
- Treating the excavated soils by ex situ bioremediation as appropriate;
- Transporting the treated soils to, and consolidating them with landfill cap foundation materials at Site LF-04 or Site WP-07, as appropriate; and
- Monitoring the groundwater if contamination that threatens groundwater quality remains at the site.

The oil-water separator and surrounding soil were excavated according to the remedial action selected in the ROD, but some contamination remained in the sidewalls of the excavation. This meant that further excavation would require building demolition and possibly large amounts of soil removal; both of which were less desirable than in situ treatment. Consequently, the Air Force prepared an Explanation of Significant Difference (AFBCA, 1998e) to document the selection of additional remedial action to complete the Site 56 cleanup. The additional remedy consists of operating an in situ

treatment system to remediate the remaining contamination to meet the cleanup standards.

7.4.3.2 Site SD-56 - Oil/Water Separator 2989: Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1996b) and the ESD (AFBCA, 1998e).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the completed remedy is still protective. The site closure process agreed to by the remedial project managers for SVE remedies includes a determination that the site poses no unacceptable health risk. This ensures that any changes in exposure assumptions or toxicity data are incorporated into the remedial action.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that calls into question the protectiveness of the remedy.

7.4.3.3 Site SD-56 - Oil/Water Separator 2989: Remedial Action Evaluation

The remedial objectives for Site SD-56 are to achieve cleanup standards for the COCs, and to mitigate any potential or residual source of groundwater contamination that may be present

The oil-water separator and surrounding soil were excavated according to the remedial action selected in the ROD, but some contamination remained. As a result, additional remediation by in situ methods was chosen by the Air Force to address the residual contamination, and documented in an Explanation of Significant Difference (AFBCA, 1998e). The original remedial action selected in the ROD was effective at removing the bulk of the contaminated soil.

The excavation remedy was documented in the Closure Report for Soil Operable Unit Site 65 and Remedial Action Characterization Report for Soil Operable Unit Sites 56, 59, 60, and 62 (Montgomery Watson, 1997b). The additional in situ treatment remedy is described in the Informal Technical Information Report for Remedial Action at Sites 56 and 60 (Montgomery Watson, 1999g), the Operations and Maintenance Manual and Manufacturers Literature for Soil Vapor Extraction/ Bioventing Systems at Sites 56 and 60 (Montgomery Watson, 1998p), and the Final Remedial Action Report for Site 56, Former Oil Water Separator, Mather Air Force Base (MWH, 2002a).

The in situ treatment system of extraction/injection and monitoring wells was built in 1998, and a pilot test conducted starting in July to determine if sufficient volatile organic contaminants were recoverable to warrant operation of the system in vapor extraction mode. The system was operated in SVE mode until mid-2000, and in bioventing mode in July and August 2000. The Remedial Action Report was prepared in 2001, concluding that residual contamination at Site SD-56 no longer threatened groundwater quality. This evaluation included monitoring data and vadose-zone Vapour T modeling for volatile organic contaminants which were not identified as COCs in the ROD. One possible contaminant, methylene chloride, was detected in both samples from Site SD-56 and laboratory blanks, indicating the detection attributed to Site SD-56 may have been a laboratory contaminant. Modeling assuming it was a site contaminant predicted it would impact water quality, but monitoring of downgradient well MAFB-233 had never detected methylene chloride (Montgomery Watson, 2002a). Regulatory agency concurrence with the site closure was obtained in 2002 (U.S. EPA, 2002b; DTSC, 2002b).

The conclusion in the 1999 five-year review that the remedial activities performed at Site SD-56 have met the protectiveness objectives as specified in the ROD is still valid. Site SD-56 was evaluated in this review despite the fact the site has been successfully closed, to provide continuity with the previous five-year review.

7.4.4 Site SD-57 - Oil/Water Separator 7019

7.4.4.1 Site SD-57 - Oil/Water Separator 7019: Remedial Action

The remedial action selected for Site SD-57 included the following major components:

- Treating the contaminated shallow and deep soils by in situ SVE; and
- Monitoring the groundwater if contamination that threatens groundwater quality remains at the site.

The ROD also contains conditions for initiating and terminating SVE remediation at Site SD-57 (See text boxes, Section 3.3.1.1).

7.4.4.2 Site SD-57 —Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1996b).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the remedy is still protective. The site closure process (Montgomery Watson, 2002c) agreed to by the remedial project managers for SVE remedies includes a determination that the site poses no unacceptable health risk. This ensures that any changes in exposure assumptions or toxicity data are incorporated into the remedial action.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that calls into question the protectiveness of the remedy.

7.4.4.3 Site SD-57 — Remedial Action Evaluation

The remedial objectives for Site SD-57 are to achieve cleanup standards for the COCs, and to mitigate any residual source of groundwater contamination that may be present

A soil vapor extraction and treatment system was constructed at Site SD-57 in 1997, and began operating in October 1997. The initial system was designed to use granular activated carbon, but was soon expanded to use catalytic oxidation technology for vapor destruction and to use more extraction and monitoring wells.

Additional wells were installed and tested as possible extraction wells in a project called 'Phase II' of the Site SD-57 remedial action, but these wells proved to be outside the zone of effective vapor removal; consequently they are now used as monitoring wells. This activity is documented in the Informal Technical Information Report for Phase I and Phase II Remedial Action at Site 57 (Montgomery Watson, 1998k). The initial Operations and Maintenance (O&M) was governed by the Operations and Maintenance Manual for the Site 57 Soil Extraction System was issued in 1997 (Montgomery Watson, 1997h)

The incremental development of system construction is further described in Informal Technical Information Report for Phase I, Phase II and Phase III Remedial Action at Site 57 (Montgomery Watson, 1999n). This report contains an evaluation of the radius of influence of the vapor extraction system, and demonstrates that the extraction system has adequate influence to address the extent of contamination identified at Site SD-57.

A remedial process optimization study was conducted at Mather, with focus on Site SD-57 (Parsons Engineering Science, 2001). This evaluation indicated that TCE concentrations had been reduced by 98.2 to 99.9 percent, but also identified a lack of vapor extraction in fine near-surface sediments, and in the deep vadose zone near the water table. As a result of this evaluation and pilot testing, dual-phase extraction was suggested and enhanced SVE (SVE coupled with air injection) was discouraged. As a result, extraction wells EW-2A, EW-4A/Bu, and EW-5A/Bu were modified to implement dual-phase extraction. These in groundwater extraction wells are screened across the water table, and applying a vacuum to the well screen enhances mass removal from both

the vadose zone and the groundwater. This system modification is documented in Appendix E of the annual groundwater monitoring report for 2001 (Montgomery Watson, 2001f). The most recent O&M manual is Montgomery Watson, 2000m.

Soil vapor extraction technology has been proven effective at Site SD-57, as documented by significant mass removal of TCE from the vadose zone (MWH, 2003e). Although the rate of mass removal has decreased considerably, the continued operation of the SVE as part of dual-phase extraction continues to enhance the local removal of contaminants from the groundwater.

7.4.5 Site SD-59 - Oil/Water Separator 4251

7.4.5.1 Site SD-59 - Oil/Water Separator 4251: Remedial Action

The remedial action selected for Site SD-59 included the following major components:

- Excavating approximately 1,200 yd³ of contaminated shallow soils to remove all contamination above acceptable levels;
- Transporting the excavated soils to the, on-base ex situ bioremediation facility;
- Treating the excavated soils by ex situ bioremediation as appropriate;
- Transporting the treated soils to, and consolidating them with landfill cap foundation materials at Site LF-04 or Site WP-07, as appropriate; and
- Monitoring the groundwater if contamination that threatens groundwater quality remains at the site.

7.4.5.2 Site SD-59 - Oil/Water Separator 4251: Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1996b) and the ESD (AFBCA, 1998e).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the remedy is still protective. The site closure process (Montgomery Watson, 2002c) agreed to by the remedial project managers for SVE remedies includes a determination that the site poses no unacceptable health risk. This ensures that any changes in exposure assumptions or toxicity data are incorporated into the remedial action.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

Recent evaluation of Site SD-59 data to assess whether the site is ready for closure revealed that the boundaries of soil vapor contamination were not adequately defined to the south. As a result, additional characterization of extent will be undertaken in 2004. The significance of soil vapor extending beyond the influence of the remedy from the identified source is that unremediated soil gas could contribute to groundwater contamination. However, unless additional uncharacterized sources of

contamination are found, this is not judged to compromise health protectiveness of the remedy.

7.4.5.3 Site SD-59 - Oil/Water Separator 4251: Remedial Objectives Evaluation

The remedial objectives for Site SD-59 are to achieve cleanup standards for the COCs, and to mitigate any potential or residual source of groundwater contamination that may be present

The soil at Site SD-59 was excavated according to the remedial action selected in the ROD, but some contamination remained in the sidewalls of the excavation. Further excavation was not possible without undermining the adjacent aircraft wash rack and possibly requiring large amounts of soil removal; both of which were less desirable than in situ treatment. Consequently, the Air Force prepared an Explanation of Significant Difference (AFBCA, 1998e) to document the selection of additional remedial action to complete the Site SD-59 cleanup. The additional remedy consists of operating an in situ treatment system (i.e. soil vapor extraction and/or bioventing) to remediate the remaining contamination to meet the cleanup standards.

The in situ extraction system was installed and pilot tested in 1998 (Montgomery Watson, 1999h); and has been operating since then to treat Site SD-59 as well as nearby Site LF-18. The treatment was initially accomplished with either catalytic oxidation or granular activated carbon, with extraction system manifolded to allow higher concentrations to be diverted to the thermal treatment and lower concentration to the GAC unit. Since early 2003, only the GAC unit has been used for treatment.

An evaluation of the influence of the extraction system was reported in 1999 (Montgomery Watson, 1999r). A comparison of this influence to the current extent of contamination reveals both that the extraction system may not be significantly influencing portions of the known extent of soil gas contamination, and that the extent of soil gas contamination is not adequately characterized to the south of existing wells. Montgomery Watson Harza staff recognized this in late 2003, and plan to propose and conduct additional characterization at Site SD-59 with the aim of satisfying data needs to determine the extent of contamination. The adequacy of the extraction system should then be evaluated with respect to the extent of contamination.

The significance of soil vapor extending beyond the influence of the remedy from the identified source is that unremediated soil gas could contribute to groundwater contamination. However, unless additional uncharacterized sources of contamination are found, this is not judged to compromise health protectiveness of the remedy.

7.4.6 Site SD-60 - Oil/Water Separator 6900

7.4.6.1 Site SD-60 - Oil/Water Separator 6900: Remedial Action

The remedial action selected for Site SD-60 includes the following major components:

- Excavating approximately 350 yd³ of contaminated shallow soils to remove all contamination above acceptable levels;
- Transporting the excavated soils to the on-base ex situ bioremediation facility;
- Treating the excavated soils by ex situ bioremediation as appropriate;
- Transporting the treated soils to, and consolidating them with landfill cap foundation materials at Site LF-04 or Site WP-07, as appropriate; and
- Monitoring the groundwater if contamination that threatens groundwater quality remains at the site.

7.4.6.2 Site SD-60 - Oil/Water Separator 6900: Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioned as intended by the ROD (AFBCA, 1996b) and the ESD (AFBCA, 1998e), and has been completed.

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the remedy is still protective. The site closure process (Montgomery Watson, 2002c) agreed to by the remedial project managers for SVE remedies includes a determination that the site poses no unacceptable health risk. This ensures that any changes in exposure assumptions or toxicity data are incorporated into the remedial action.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that calls into question the protectiveness of the remedy.

7.4.6.3 Site SD-60 - Oil/Water Separator 6900: Remedial Objectives Evaluation

The remedial objectives for Site SD-60 were to achieve cleanup standards for the COCs, and to mitigate any potential or residual source of groundwater contamination that may be present.

The excavation remedy for Site SD-60 was implemented according to the ROD. However, some contamination remained and additional excavation was not practical due to the depth limitations and the proximity of the adjacent aircraft maintenance hangar. Therefore the Air Force decided to initiate additional remedial action by in situ treatment.

The excavation remedy was documented in the Closure Report for Soil Operable Unit Site 65 and Remedial Action Characterization Report for Soil Operable Unit Sites 56, 59, 60, and 62 (Montgomery Watson, 1997b). The plans for the additional in situ treatment remedy are contained in the Technical Information Report for Remedial Action at Sites 56 and 60 (Montgomery Watson, 1999g). Additional system information is found in the Operations and Maintenance Manual and Manufacturers Literature for Soil Vapor Extraction/ Bioventing Systems at Sites 56 and 60 (Montgomery Watson, 1998p). The in situ treatment system of extraction/injection and monitoring wells was built in 1998, and operated in soil vapor extraction mode (i.e. Montgomery Watson, 1999h) until December 2000, after which a rebound test was conducted.

During monitoring of the soil vapor extraction system, contaminants were been detected that were not identified in the ROD as contaminants of concern. The significance of these additional contaminants was evaluated prior to terminating the SVE system operation, including their persistence, extent, and presence in nearby groundwater. The narrative standards in the ROD were applied to evaluate all contaminants with potential to significantly threaten groundwater quality.

The contaminants that still were detected when Site SD-60 was evaluated for closure were all evaluated for threat to water quality using vadose-zone Vapour T modeling as described in the remedial action report (Montgomery Watson, 2001n). These contaminants included some that were not identified in the ROD as contaminants of concern. The vadose zone indicated that the residual trace concentrations of contaminants did not pose a significant threat to water quality.

A remedial action closure report was submitted in 2001 (Montgomery Watson, 2001n) and concurrence from the regulatory agencies was obtained in 2002 (U.S. EPA, 2002a; DTSC, 2002a). The conclusion in the 1999 five-year review that the remedial activities performed at Site 60 have met the protectiveness objectives as specified in the ROD is still valid. Site SD-60 was evaluated in this review despite the fact the site has been successfully closed, to provide continuity with the previous five-year review.

7.5 Landfill OU Selected Remedies

The Landfill OU addresses only remedies related to contamination of the soils at Sites LF-01 through LF-06. Any contamination of the groundwater underlying these sites is addressed as part of a separate Groundwater OU ROD.

7.5.1 Explanation of ARARs for Landfill OU Sites LF-03 and LF-04 and the Site WP-07 Landfill

The Applicable or Relevant and Appropriate Regulations (ARARs) cited in the Landfill Operable Unit Record of Decision remain protective of human health and the environment. These same ARARs were identified for the Site WP-07 landfill in the Soil OU ROD.

The landfill ARARs from titles 14 and 23 of the California Code of Regulations have been revised since the Landfill ROD was issued. These regulations have been combined, revised, and recodified in Title 27 of the California Code of Regulations. Of the affected ARARs, those solely governing the operation of Landfill Site LF-04 while it was accepting waste consolidated from sites LF-02, LF-05, and LF-06 are no longer applicable to the site, since the site is now closed. Only the ARARs addressing the post-closure status of landfill sites LF-03 and LF-04 remain applicable or relevant and appropriate. These are summarized here, with a general Title 27 citation provided for cross-reference. However, the cross-reference may not be an exact equivalent to the ARAR cited in the RODs. Some of the sections were reworded or edited, or may have additional content. Consequently the current regulatory citations are not necessarily equivalent to the ARARs, and it is possible that some of the Title 27 citations might not contain ARAR (i.e. substantive) portions of the regulations. As the ARAR citations are the same for both Site LF-03 and Site LF-04, and these are also cited for Site WP-07, this discussion is relevant to these three sites.

Table 11: Recodified Post-closure Landfill ARARS – General cross-reference to Title 27

ARARs Citation	Title 27 Citation	Notes
14 CCR 17766 Emergency Response Planning	27 CCR 21130	
14 CCR 17767 Site Security	27 CCR 21135	
14 CCR 17773(b) to (e) Final Cover Design	27 CCR 21140	Potentially relevant to post-closure maintenance
14 CCR 17774(a) & (c) to (h) Construction Quality Assurance	27 CCR 20324	Potentially relevant to post-closure maintenance
14 CCR 17776(a), (c) to (f) Final Grades	27 CCR 21142, 21769	Potentially relevant to post-closure maintenance
14 CCR 17777(a) to (c) Final Site Face	27 CCR 21090, 21142, 21145	Potentially relevant to post-closure maintenance

ARARs Citation	Title 27 Citation	Notes
14 CCR 17778(a) & (c) to (j), Final Drainage	27 CCR 20365, 21150, 21769	Potentially relevant to post-closure maintenance
14 CCR 17779(a) & (c) to (i), Slope Protection and Erosion Control	27 CCR 21090	Potentially relevant to post-closure maintenance
14 CCR 17783, Gas Monitoring and Control	27 CCR 20918, 20921 -, 20937, 21160	
14 CCR 17788, Post-closure Maintenance	27 CCR 21180(a)	
14 CCR 17796, Post-closure Land Use	27 CCR 21190	
23 CCR 2511(d), Applicability	27 CCR 20090	
23 CCR 2541(d), Containment Materials	27 CCR 20320	Potentially relevant to post-closure maintenance
23 CCR 2546(a) & (c) to (f), Drainage Control	27 CCR 20365	
23 CCR Article 5, Groundwater Monitoring	27 CCR 20380 – 20435, 22222	
23 CCR 2580(a), Post-closure Maintenance	27 CCR 20950(a)	
23 CCR 2580(d), Monuments	27 CCR 20950(d)	
23 CCR 2580(e), Vegetation	27 CCR 20950(e)	
23 CCR 2581, Maintenance of Final Cover	27 CCR 21090	
23 CCR 2597, Post- closure Maintenance	27 CCR 21769	

Based upon the continued protectiveness of the ARARs identified in the ROD, and satisfaction of the Integrated Waste Management Board and the Regional Water Quality Control Board that the listed ARARs are equivalent to the recodified regulatory requirements, it is recommended that no changes to the ARARs citations be made.

7.5.2 Landfill Site LF-03

7.5.2.1 Landfill Site LF-03 – Remedial Action

The selected remedy for Site LF-03 is an engineered cap. The major components of this remedy include:

- Installing an engineered cap;
- Installing passive gas vent wells;
- Monitoring of groundwater and landfill gas; and
- Invoking access restrictions.

7.5.2.2 Landfill Site LF-03 - Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1995)

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, which may, if adopted, be used to reassess the risk of potential exposure to landfill gas emissions, but the remedy is still protective.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that calls into question the protectiveness of the remedy.

7.5.2.3 Landfill Site LF-03 – Remedial Objectives Evaluation

The remedial objectives of the Site LF-03 remedial action are to close the landfill in compliance with ARARs, and to thereby protect human health and the environment.

Site LF-03 was closed and capped successfully in 1996. The site lies in the clear zone at the approach/departure area beyond the northeast end of Mather's runways. The site is fenced, and the site is protected from disturbance by conditions in the lease to Sacramento County. Landfill gas monitoring indicates that the site is in compliance with gas standards, and groundwater monitoring has detected no contaminant plume associated with Site LF-03 (i.e. MWH, 2003e; MWH 2003h). The ARARs dictate that groundwater monitoring may be terminated when it is demonstrated that leachate from the landfill poses no threat to water quality, and gas monitoring may be terminated when it is demonstrated that there is no potential for gas migration beyond the property boundary or into on-site structures (of which there are none at Mather's landfill sites).

Post-closure inspections are reported quarterly (i.e., Montgomery Watson, 1999a; MWH 2003g). A topographic survey was undertaken in late 2003 to evaluate any changes since the landfill cap was constructed in 1996. The results are not yet published, but a preliminary examination reveals no significant changes at landfill Site 3. This indicates there are no areas of significant erosion, settling, or subsidence that could compromise the integrity of the landfill cap.

7.5.3 Landfill Site LF-04

7.5.3.1 Landfill Site LF-04 — Remedial Action

The selected remedy for Site LF-04 is an engineered cap and embankment. The major components of this remedy include:

- Installing an engineered cap;
- Installing flood control measures (e.g., embankment);
- Installing passive gas vent wells;
- Monitoring of groundwater and landfill gas; and
- Invoking access restrictions.

7.5.3.2 Landfill Site LF-04: Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1995) the ESD (AFBCA, 1996e), and two removal action memoranda which resulted in additional waste consolidation into Site LF-04 (AFBCA, 1996c, 1996d).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, which may, if adopted, be used to reassess the risk of potential exposure to landfill gas emissions, but the remedy is still protective.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

The concern identified in the prior five-year review that landfill gas might migrate to the north of landfill LF-04 and onto adjacent property has been addressed by installation of a series of gas intercept trenches. No other information has come to light that calls into question the protectiveness of the remedy.

7.5.3.3 Landfill Site LF-04 - Remedial Objectives Evaluation

The remedial objectives of the Site LF-04 remedial action are to close the landfill in compliance with ARARs, and to thereby protect human health and the environment.

Site LF-04 was closed and capped successfully in 1996. The site lies beneath the flight path beyond the northeast end of Mather's runways. The site is fenced, and the site is protected from disturbance by conditions in the lease to Sacramento County.

The initial landfill gas monitoring indicated that the site was not in compliance with gas standards. Corrective measures were implemented in 1998 in the form of a series of gas migration intercept trenches with vent pipes and wind turbines along the northern boundary of Site LF-04. The methane gas concentrations have decreased from greater than 50% before the trench installation to 17% in December 1998, to below 5% in November 1999. Methane concentrations have been well below 5% since then. A contingency plan has been prepared to address additional measures to be taken should the gas concentrations fail to meet the standards in a reasonable amount of time (Montgomery Watson, 1999c). Groundwater monitoring for the required suite of analytes continues; an organic contaminant plume that apparently originates at Site LF-04 is being monitored under the remedial action for the Northeast Plume (i.e. MWH, 2003ed; MWH 2003h). The ARARs dictate that groundwater monitoring may be terminated when it is demonstrated that leachate from the landfill poses no threat to water quality, and gas monitoring may be terminated when it is demonstrated that there is no potential for gas migration beyond the property boundary or into on-site structures (of which there are none at Mather's landfill sites).

Post-closure inspections continue and are reported quarterly (i.e., Montgomery Watson, 1999a; MWH 2003g). A topographic survey was undertaken in late 2003 to evaluate any changes since the landfill cap was constructed in 1996. The results are not yet published, but a preliminary examination reveals areas with slightly more than a foot of decreased elevation in portions of landfill Site LF-04. The areas with decreased elevation are more pronounced on the flanks of the landfill cap where slopes are steepest, and not seen to the same degree on the central portions of the cap. This suggests that the change could be due to settling where soil wasn't compacted as effectively rather than subsidence where waste had degraded, as the latter would be expected to affect the entire cap area. Despite these changes, inspection reveals no areas of significant erosion or offset that would indicate settling, or subsidence that could compromise the integrity of the landfill cap. A more formal documentation of the topographic assessment will be included in the annual landfill monitoring report.

7.6 Basewide OU Selected Remedies and Remedial Objectives Evaluations

7.6.1 Sites FT-10C/ST-68 – Former Fire Department Training Area No. 3 and Fuel Transfer Station

7.6.1.1 Sites FT-10C/ST-68 – Former Fire Department Training Area No. 3 and Fuel Transfer Station – Remedial Action

The remedial action selected for Site FT-10C/ST-68, Former Fire Department Training Area No. 3/Two 2,000 Gallon and Sixteen 50,000 Gallon Underground Storage Tanks at Fuel Transfer Station, includes the following major components:

- In situ treatment of the fuel contaminated subsurface soils at Sites FT-10C and ST-68; and
- Treatment of offgas by granular activated carbon or more cost-effective means of best available control technology as necessary to comply with ARARS.
- Monitoring any thermal treatment effluent for dioxins (at least three sampling events during the first month of operation), and conducting a risk assessment if emissions exceed 0.2 nanograms per dry standard cubic meter.

The ROD contains the following SVE initiation text:

The actual decision on whether to build and operate an SVE system will depend on the degree to which the contamination presents a threat to ground water and whether site characteristics are suitable for the SVE technology. It is generally preferable from a technical and cost perspective to clean up contamination in the vadose zone before it reaches the ground water. The feasibility analysis will be prepared by the Air Force as a primary document. The decision will be made by the signatory parties to the FFA and will be based, at a minimum, on the following factors:

- a. The cost and time associated with the predicted additional groundwater remediation if no SVE is implemented;
- b. The cost of implementing the SVE system to meet the SVE soil cleanup standard;
- c. The incremental cost over time of vadose zone remediation compared to the incremental cost of groundwater remediation, on the basis of a common unit (e.g., cost to remove a pound of TCE), provided that the underlying groundwater has not reached aquifer cleanup levels;
- d. The results of VLEACH or another appropriate vadose zone model, in conjunction with a groundwater fate and transport model to predict the resulting concentration from the vadose zone contamination in the nearest groundwater wells monitoring the site;
- e. The results of VLEACH or another appropriate vadose zone model, that interprets soil gas data, to predict the mass and concentration of discharges from the vadose zone to the groundwater;

This demonstration is to be made prior to operation of the bioventing system in areas considered for SVE (to prevent interference from bioventing). Once SVE is initiated, it will be terminated in accordance with the demonstration required for Site 57 (ROD Section 2.2.9.7). The need to implement the bioventing remedy will be reevaluated when SVE is terminated.

SVE termination will be in accordance to the following ROD text that also applies to Site LF-18 and Site OT-23:

The goal of cleaning up the vadose zone is to minimize further degradation of the groundwater by the contaminants in the soil. It is generally preferable from a technical and cost perspective to clean up contamination in the vadose zone before it reaches the groundwater. The soil cleanup standard will be achieved when the residual vadose zone contaminants will not cause the groundwater cleanup standard, as measured in groundwater wells monitoring the plume, to be exceeded after the cessation of the groundwater remediation. The Air Force will make the demonstration that the standard has been met through contaminant fate and transport modeling, trend analysis, mass balance, and/or other means. This demonstration will include examination of the effects of the residual vadose zone contamination in the groundwater using VLEACH or another appropriate vadose zone model, in conjunction with a groundwater fate and transport model, to predict the resulting concentration from this residual vadose zone contamination in the nearest groundwater remediation. The Air Force shall provide verification, through actual data, that the above standard has been met. The signatory parties to this Record of Decision (ROD) will jointly make the decision that the soil cleanup standard has been met.

The Air Force shall operate the SVE system until it makes the demonstration that the cleanup standard, set forth above, has been met. The Air Force shall continue to operate the SVE system if appropriate, after considering the following factors:

Whether the mass removal rate is approaching asymptotic levels after temporary shutdown periods and appropriate optimization of the SVE system;

The additional cost of continuing to operate SVE system at concentrations approaching asymptotic mass levels;

- Whether the predicted concentration of the leachate from the vadose zone (using VLEACH or another appropriate vadose zone model that interprets soil gas data) will exceed the groundwater cleanup standard;
- The predicted effectiveness and cost of further enhancements to the SVE system (e.g., additional vapor extraction wells);
- Whether the cost of groundwater remediation will be significantly more if the residual vadose zone contamination is not addressed;
- Whether residual mass in the vadose zone will significantly prolong the time to attain the ground water cleanup standard; and

(continued)

- The incremental cost over time of vadose zone remediation compared to the incremental cost over time for groundwater remediation on the basis of a common unit (e.g., cost of pound of TCE removed) provided that the underlying groundwater has not reached aquifer cleanup levels.

The signatory parties agree that the Air Force may cycle the SVE system on and off in order to optimize the SVE operation and/or to evaluate the factors listed above.

The signatory parties to this ROD will jointly make the decision that the SVE system may be shut off. If the parties cannot reach a joint resolution, any party may invoke dispute resolution. This ROD does not resolve the ARAR status of State requirements regarding the establishment of soil cleanup levels. The parties agree that in the event of a dispute regarding SVE shutoff, the State may argue its authority to require soil cleanup (including soil cleanup standards) as the basis for continuing operation of the SVE system, based on the above factors.

7.6.1.2 Sites FT-10C/ST-68 —Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1998b).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the remedy is still protective. The site closure process (Montgomery Watson, 2002c) agreed to by the remedial project managers for SVE remedies requires a determination that the site poses no unacceptable health risk as a condition of closure. This ensures that any changes in exposure assumptions or toxicity data are incorporated into the remedial action.

C. Has any other information come to light that could call into question the protectiveness of the remedy? -

There have been two discoveries of additional contamination after the remedy selection. The first was an area of debris and petroleum contamination north of Truemper Way; and the second was the discovery of a shallow ash layer beneath a portion of Truemper Way that contains elevated lead concentrations. The debris was removed by excavation in 2002; and the remaining petroleum contamination is being treated with the in situ treatment system. The ash layer is planned for excavation in 2004,

such that no residual lead contamination remains that would require any use restrictions on this site. No other information has come to light that calls into question the protectiveness of the remedy.

7.6.1.3 Sites FT-10C/ST-68 — Remedial Objectives Evaluation

The remedial objectives for Site 10C/68 are to achieve cleanup standards for the COCs, and to mitigate any potential or residual source of groundwater contamination that may be present

An in situ treatment system was installed at Sites FT-10C/ST-68 in 1997 and operated as a pilot test in soil vapor extraction mode to determine if sufficient volatile organic contaminants were recoverable to warrant operation of the system in vapor extraction mode. The initial soil vapor data indicated very few volatile contaminants were being removed. Consequently the system was then tested in bioventing mode, and then operated from mid-1998 to mid-1999 in bioventing mode. Concern by the RWQCB that some chlorinated volatile contaminants could remain in deep soils at the site resulted in another SVE pilot test in early 1999 using a water table monitoring well as a test extraction well. The test indicated that SVE using these wells could be productive and also provide aeration of the shallower depths to promote bioremediation. Therefore, the system was converted to SVE mode starting in June 1999 (Montgomery Watson, 1999h). The system was again converted to bioventing mode in early 2000, then to SVE in mid-2001 to address petroleum contamination on the north side of Truemper Way. Further investigation in this area revealed buried debris, which was then evaluated with a magnetic survey. After excavation of debris and some contaminated soil, the SVE system was expanded into the area of residual petroleum contamination in 2002.

During monitoring of the soil vapor extraction system, contaminants have been detected that were not identified in the ROD as contaminants of concern. The significance of these additional contaminants will be evaluated prior to terminating the SVE system operation, including their persistence, extent, and presence in nearby groundwater. The narrative standards in the ROD will be applied to any additional contaminants that significantly threaten groundwater quality.

The remedial action at Site FT-10C/ST-68 has evolved in response to site monitoring and critical evaluation of the site data. As a result, the remedial action has continued to reduce the threat to water quality and has continued to make progress toward the remedial goals. The radius of influence of the vapor extraction system was evaluated in the Site Investigation and SVE Installation Report (EA Engineering, 1997), and it appears that the contamination on the south side of Truemper Way was adequately addressed by the system except for perhaps the deeper contamination near the water table that was later addressed by converting groundwater monitoring wells to vapor extraction wells. However, the adequacy of system influence will be better assessed by evaluating vapor monitoring data over time, with periodic evaluations as to the progress of the remedial action.

Additional contamination was discovered under Truemper Way during repair of a sewer line by Sacramento County. Follow-up investigation revealed a shallow ash layer which contains elevated concentrations of lead. This presumably is related to the fire training activities which occurred historically at this site. The contaminated material is planned for excavation in 2004.

The remedial action at Site FT-10C/ST-68 is judged protective of human health and the environment. However, in addition to the contamination identified in the ROD, there is the additional lead contamination beneath Truemper Way that presents a potential health risk. At the time of this review, provisions in the airport lease and the roadway easement prohibit unauthorized excavation in this area. The excavation and disposal of the soil containing lead contamination is planned to occur in 2004 once an explanation of significant difference and a work plan are finalized.

7.6.2 Site LF-18 — Old Burial Site

7.6.2.1 Site LF-18 — Old Burial Site — Remedial Action

The remedial action selected for Site LF-18 includes the following major components:

- Installing an in situ SVE system comprised of extraction wells and possibly passive injection wells; and
- Treatment of offgas by granular activated carbon or more cost-effective means of best available control technology as necessary to comply with ARARS.
- Monitoring any thermal treatment effluent for dioxins (at least three sampling events during the first month of operation), and conducting a risk assessment if emissions exceed 0.2 nanograms per dry standard cubic meter.

SVE termination will be in accordance with the text in the text box in the preceding section for Sites FT-10C/ST-68.

7.6.2.2 Site LF-18 - Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1998b).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the remedy is still protective. The site closure process (Montgomery Watson, 2002c) agreed to by the remedial project managers for SVE remedies includes a determination that

the site poses no unacceptable health risk. This ensures that any changes in exposure assumptions or toxicity data are incorporated into the remedial action.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that calls into question the protectiveness of the remedy.

7.6.2.3 Site LF-18 — Remedial Objectives Evaluation

The objective of the remedial action is to reduce the overall cost and duration of the groundwater remedial action by removing contamination from the vadose zone before it enters the underlying groundwater. The remedial action extraction system at Site 18 was constructed in two phases, in late 1998 and mid-1999. The SVE treatment system was installed and began operation in 1999 (Montgomery Watson, 1999r; MWH, 2003). The thermal treatment unit was replaced with a granular activated carbon adsorption unit in mid-2000, as the influent concentrations dropped. As of December 2003, the SVE system continued to operate effectively to remove of contaminants by granular activated carbon adsorption.

An evaluation of the influence of the extraction system was reported in 1999 (Montgomery Watson, 1999r). A comparison of this influence to the historic and current extent of contamination indicates that this influence is adequate to address the extent of contamination.

The remedial action is judged to be protective of human health and the environment.

7.6.3 Site OT-23 — Sanitary Sewer Line, Main Base Area

7.6.3.1 Site OT-23 — Sanitary Sewer Line, Main Base Area — Remedial Action

The remedial action selected for Site OT-23 includes the following major components:

- Installing an in situ SVE system comprised of extraction wells and passive injection wells; and
- Treatment of offgas by granular activated carbon or more cost-effective means of best available control technology.
- Monitoring any thermal treatment effluent for dioxins (at least three sampling events during the first month of operation), and conducting a risk assessment if emissions exceed 0.2 nanograms per dry standard cubic meter.

SVE termination will be in accordance with the text in the text box in the preceding section for Sites FT-10C/ST-68.

7.6.3.2 Site OT-23 — Evaluation Questions

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1998b).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes (See Section 7.1). There have been changes in toxicity data, but the remedy is still protective. The site closure process (Montgomery Watson, 2002c) agreed to by the remedial project managers for SVE remedies includes a determination that the site poses no unacceptable health risk. This ensures that any changes in exposure assumptions or toxicity data are incorporated into the remedial action.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that calls into question the protectiveness of the remedy.

7.6.3.3 Site OT-23 - Remedial Action Evaluation

Site OT-23 consists of portions of the sanitary sewer system serving the Main Base portion of the former Mather Air Force Base. Investigation revealed specific locations along the sewer alignments where contamination was significant (IT Corp, 1996b); these were identified in the ROD as 23A, 23B, 23C, and 23D (AFBCA, 1998b). Locations 23A, 23B, and 23D are being addressed by soil vapor extraction at sites LF-18, SD-59, and ST-37/ST-39/SS-54, respectively. Location 23C as identified in the ROD only has significant soil vapor just above the water table. Further investigation of the water table contamination in the area revealed the former site of a dry cleaning facility about two blocks to the northeast of location 23C (Montgomery Watson, 1999r). The contamination resulting from the dry cleaning facility has been referred to as Site 23C in later documentation, and is the focus of this evaluation.

The objective of the remedial action is to reduce the overall cost and duration of the groundwater remedial action by removing contamination from the vadose zone before it enters the underlying groundwater.

The soil vapor extraction and monitoring wells were installed in several efforts starting in October 1998 and finishing in July 1999. The SVE treatment unit installation was completed in March 2000, and began operating in April. The system used a catalytic oxidation treatment for the vapors until January 2002, when the thermal treatment was

replaced by a granular activated carbon adsorption unit (MWH, 2003). As of December 2003, the system continues to operate using granular activated carbon adsorption to capture vapors, and had removed more than 3500 pounds of reactive organic contaminants, about 2/3 of which was PCE.

The influence of the Site 23C vapor extraction system is evaluated in the latest semi-annual monitoring report (MWH, 2003), and appears to be adequate to address the contamination originating from the former dry cleaning site.

The several areas of significant contamination associated with Site OT-23 (referred to as Site 23A, 23B, 23C, and 23D in the ROD) is being addressed directly at through the Site 23C vapor extraction system, and indirectly by extraction systems associated with Site ST-37/ST-39/SS-54 (23B, 23D) and Site LF-18/SD-59 (23A). However, vapor monitoring points have not been installed specifically for locations 23A, 23B, or 23D to determine whether the influence of extraction wells is adequate and to monitor the progress of remediation. There is no doubt that progress is being made toward the remedial objective, and it is judged that the remedy is health protective. However, the adequacy of the monitoring system should be evaluated in detail as part of the in situ treatment monitoring program.

7.6.4 Site OT-87 — Skeet/Trap Range

7.6.4.1 Site OT-87 — Skeet/Trap Range — Remedial Action

The remedial action selected for Site OT-87 includes of the following major components:

- Excavating approximately 28,000 cubic yards of contaminated sediments and surface soils to a 6 inch depth through the fall zone of the lead shot;
- Stabilizing (if needed for disposal) approximately 28,000 cubic yards of contaminated sediments and surface soils;
- If any surface water is present, constructing diversion dams to channel the water flow away from the areas to be excavated. These dams would be removed following completion of the excavation activities. If diversion dams are not appropriate, the water will be discharged to the POTW, if approved by Sacramento County;
- Transporting the soil, stabilized as necessary, to Site WP-07 for use as foundation material in construction of a cap, or an off-base facility if sample screening indicates that Site WP-07 acceptance criteria are not met;
- Backfilling the excavated areas with uncontaminated soils and/or recontouring to create effective drainage; and
- Institutional controls will be implemented with the goal of protecting human health.

7.6.4.2 Site OT-87 – Skeet/Trap Range – Remedial Objectives Evaluation

A. Is the remedy functioning as intended by the decision documents?

The remedy is functioning as intended by the ROD (AFBCA, 1998b).

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Yes. There have been no changes in toxicity data, and the remedy is protective.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that calls into question the protectiveness of the remedy.

7.6.4.3 Site OT-87 – Skeet/Trap Range – Remedial Action Evaluation

The remedial action for Site OT-87 was implemented in the fall and winter of 1998. The site was successfully excavated, and the excavated material stabilized and transported to Site WP-07 for incorporation into the foundation for the landfill cap. The results of sampling to confirm that the cleanup standards have been met are documented in the Informal Technical Information Report for Remedial Action at Sites 15, 20, 85, 86, and 87 (Montgomery Watson, 1999s). According to this report, the mean lead concentration in the soil after the remedial action is 169.5 mg/kg, and the 90% upper confidence limit estimate of the mean is 226.6 mg/kg, indicating that lead at Site OT-87 has been cleaned up to well below the cleanup standard of 700mg/kg.

The cleanup level established in the ROD for lead in soil at Site OT-87 is 700 parts per million. This concentration, if left in the surface soil, would not allow unrestricted land use. The results of confirmation sampling indicate that parts of the Site OT-87 area contain lead concentrations above the California screening level of 130 mg/kg, but below the U.S. EPA residential preliminary remediation goal of 400 mg/kg. Use restrictions to avoid significant exposure to the residual lead at Site OT-87 are implemented through Air Force ownership of the land, and through the terms of the lease to Sacramento County for use of the land as a regional park. When the ownership of the property is transferred to the County, the institutional controls will be incorporated in the deed or other transactional documents.

7.7 Site Visit Information

The Air Force Real Property Agency (AFRPA, formerly called the Air Force Base Disposal Agency and then the Air Force Base Conversion Agency) has maintained contract environmental staff at the former Mather Air Force Base (Mather) since base

closure in 1993. AFRPA and Air Force Center for Environmental Excellence (AFCEE) staff are located at McClellan, CA, about 10 miles from Mather. Through these personnel as well as on-site remedial action contractors and regulatory staff visits, the Air Force has maintained familiarity with environmental remediation activities and site conditions. William Hughes, primary author of this review, has visited each remedial action system during the course of the review.

For purposes of this review, the latest landfill inspection report (MWH, 2003g) fulfills the function of a documented site visit to sites LF-03, LF-04, and WP-07. In the inspection report are recorded the conditions of the landfill gas monitoring wells, the caps, and the drainage systems for landfill sites LF-03, LF-04, and WP-07.

8.0 ISSUES IDENTIFIED DURING FIVE-YEAR REVIEW

Three issues were raised by the regulatory remedial project managers (RPMs) to be considered during the current five-year review. These issues are addressed in sections 5 and 7 of this report. The U.S. EPA requested consideration of the latest TCE risk estimates, and an evaluation of health risk to exposure from soil vapor contamination migrating into buildings. The U.S. EPA stated that there was not concern about migration of gas from the groundwater when the groundwater is more than 100 feet below the ground surface. U.S. EPA requested at the August BCT meeting that air stripper emissions be evaluated using the most recent Region IX preliminary remediation goal (PRG) risk factors. The Department of Toxic Substances Control (DTSC) requested that a state law authorizing DTSC to enter into land use covenants to implement and enforce institutional controls be evaluated as a change in standards. The RWQCB requested evaluation of revisions to state National Pollutant Discharge Elimination System (NPDES) permit requirements, in particular with respect to a NPDES permit issued for discharge to Mather Lake of treated water from the AC&W groundwater treatment plant, and requested that the AC&W treatment system effluent that discharges to Mather Lake be monitored for all the State Implementation Plan constituents of concern, and that the results be evaluated in the five-year review. The Air Force agreed to evaluate the State Implementation Plan monitoring requirements with respect to the AC&W discharge and the result will be a recommendation as to whether to monitor the constituents identified by the State Implementation Plan.

In addition to these three issues, there have been changes in the health risk associated with several of the contaminants of concern at Mather. The three issues raised by the regulatory agencies are discussed in Section 5; the changes in health risk estimates are addressed in Section 7.

Upon evaluation of these issues, only one of these issues was judged to be an immediate concern for protection of human health. The possibility that soil vapor could migrate from the water table into overlying buildings is predicted by a Johnson Ettinger model (see Section 5.3.1.2) simulation requested by U.S. EPA. The use of the risk estimate incorporated in U.S. EPA guidance coupled with this model suggests that unacceptable risk to human health could be present from exposure to trichloroethene (TCE) vapors in indoor air over a portion of the Main Base/SAC Area groundwater plume. While both the model and the risk estimate could be questioned, the most productive step to address this issue is to collect shallow soil gas samples in the area of greatest concern. The Air Force does not expect TCE to be detectable, based upon distributions of soil vapor observed elsewhere, but believes the gas monitoring to be the best way to address the concern raised by the predictive modeling. If TCE is detected at concentrations of concern, then it should be sampled in the nearby indoor air and additional steps may be necessary to protect human health from exposure to this contaminant in indoor air.

Two other issues were identified during the review that should be addressed soon in order to maintain effective progress at some sites.

The newly discovered soil with lead contamination underlying a portion of Truemper Way at Site 10c/68 is not yet formally addressed under the Mather CERCLA program. The recommended action is to excavate and dispose of this contaminated soil. An explanation of significant difference is being prepared to authorize this excavation.

In addition, several sites with in situ treatment should be further evaluated to be sure that the influence of vapor extraction systems is adequate and adequately monitored. At Site 59, this will require additional characterization of contaminant extent to the south. At Site 23, additional vapor monitoring points may be necessary at locations 23A, 23B, and 23D.

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

This section describes recommendations related to the issues identified in Section 8, and identifies the date by which the next five-year review must be accomplished.

9.1 Recommendations to Address Issues

The following recommendations are associated with issues identified during the course of this review and described in Section 8.

9.1.1 Recommendations to Assess Risk from Indoor Air

The modeling process recommended by U.S. EPA guidance predicts that TCE could migrate from the water table to the ground surface and into buildings. The model predicts that the concentration of TCE in indoor air above water table concentrations above about 60 ug/L health risk could be unacceptable, based upon a proposed risk factor for TCE. Although the Air Force has not adopted the proposed risk factor, the Air Force believes the best way to address this issue is to measure TCE concentrations in indoor air, or in shallow soil gas, in order to validate or refute the model predictions. The Air Force is developing a sampling strategy for review by the regulators for implementation in mid-2004.

9.1.2 Recommendations to Address Lead beneath Truemper Way

The shallow soil beneath Truemper Way that contains lead and ash is likely related to Site 10C fire training activities. This lead is planned to be addressed under an explanation of significant difference to the Basewide Operable unit ROD in 2004.

9.1.3 Recommendation to Address In Situ Treatment Sites 23 and 59

Additional work is required to ensure that extent of contamination is determined at Site 23 (subsites 23A, 23B, and 23D) and Site 59, and to ensure that the extraction systems relied upon to remediate this contamination are both adequate and adequately monitored. It is recommended that this be a focus of the SVE program management during 2004.

9.2 Next Five-Year Review

The next five-year review must be conducted no later than five years after the finalization of this review report, which is currently set to be no later than June 29, 2004. According to the terms of the FFA for Mather, review of operable units will be conducted every five years counting from the initiation of the first operable unit, until initiation of the final remedial action for the Site. At that time a separate review for all operable units shall be

conducted. Review of the final remedial action (including all operable units) shall be conducted every five years, thereafter. This would require the next review date to occur within 15 months after the Supplemental Basewide OU ROD, or sometime in 2005 based upon current anticipated schedules for the last operable unit. This requirement was superseded (based upon the expectation that the Supplemental Basewide OU ROD would be issued in 2001) and the date was adjusted to June 29, 2004, by consensus of the signatory parties to the FFA for Mather, for the current review. However, the prior five-year review report was finalized on September 24, 1999, and therefore the remedial project managers may decide under the FFA to delay finalization of this report if necessary, to as late as September 24, 2004. Therefore the next review after this one must be conducted by June 29, 2009, unless the finalization of this report is delayed.

10.0 STATEMENT ON PROTECTIVENESS

Based on the information provided in this Five-Year Review Report, it is determined that the remedial actions selected and implemented for environmental contamination at sites at Mather AFB, and for groundwater contaminated by historical activities at Mather AFB, are functioning as designed, and are protective of human health and the environment. It is further determined that all necessary operations and maintenance are being performed.

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Mather Five-Year Review

Appendix A

Indoor Air Migration Simulation

Using Johnson Ettinger Model

This appendix contains model output from the spreadsheets that perform Johnson and Ettinger models GW SCREEN and GW ADV as described in the User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings (U.S. EPA, June 19, 2003).

The guidance identifies a screening value of 5.3 ug/L for TCE at the water table, above which concentration there may be concern about vapor intrusion into indoor air that results in unacceptable human health risk (i.e. above 10^{-4}). If groundwater exceeds this value, vapor transport modeling is recommended. The use of representative soil characteristics in all but the coarsest, most permeable sediments is expected to result in a lower estimate of risk, or in other terms, a higher groundwater concentration would be associated with an unacceptable risk than the default screening value in the guidance.

The vadose zone soil types used for the model were from MBS EW1ABu, which has the highest groundwater concentration at the water table that does not have an associated SVE system to mitigate soil gas migration to the surface. The lithologic log for this well is included in this appendix.

The first two model runs presented in this appendix are of GW SCREEN, and represent the vadose zone as one soil type, and calculate the groundwater concentration that is predicted to result in an indoor air risk of 10^{-4} in an overlying building. The two soil types chosen represent the range of soil types used in the more advanced model that was subsequently run. These two model runs each predict a groundwater concentration that represents a site-specific screening value to be used in lieu of the 5.3 ug/L initial screening value for TCE. The range of these values is 60 to 74 ug/L TCE.

The final model run is of GW ADV, which uses three layers to represent the vadose zone. This model was run to estimate the risk associated with the measured groundwater concentration of 230 ug/L TCE, and predicts an associated risk in a building overlying this groundwater concentration to be 6.5^{-4} .

While there are many uncertainties in the model predictions, this report recommends empirical measurements of indoor air and/or shallow soil gas to confirm or refute the model predictions.

DATA SHEET

GW-SCREEN
Version 3.0; 04/03

Reset to
Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES ☒

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES ☐

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_w ($\mu\text{g/L}$)	Chemical
79016		Trichloroethylene

MORE
↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_s ($^{\circ}\text{C}$)	ENTER Average vapor flow rate into bldg (Leave blank to calculate) Q_{soil} (L/m)
15	2700	S	18	0.25

MORE
↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type Lookup Soil Parameters	ENTER Vadose zone soil dry bulk density, ρ_b^v (g/cm^3)	ENTER Vadose zone soil total porosity, n^v (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^v (cm^3/cm^3)
SL			SL	1.62	0.387	0.103

one soil
type used to
represent vadose zone →

MORE
↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-04	1	70	30	30	350

Used to calculate risk-based
groundwater concentration.

CHEMICAL PRIORITIES SHEET

ABC										
Diffusivity in air, D_a (cm ² /s)	Diffusivity in water, D_w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m ³ /mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m ³) ⁻¹	Reference conc., RIC (mg/m ³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	4.0E-02
END										

INTERMEDIATE CALCULATION SHEET

Source- building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm ³ /cm ³)	Vadose zone effective total fluid saturation, S_{fe} (cm ³ /cm ³)	Vadose zone soil intrinsic permeability, k_i (cm ²)	Vadose zone soil relative air permeability, k_{rg} (cm ²)	Vadose zone soil effective vapor permeability, k_v (cm ²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm ³ /cm ³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm ³ /cm ³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm ³ /cm ³)	Floor- wall seam perimeter, X_{crack} (cm)
2685	0.321	0.003	1.01E-07	0.998	1.00E-07	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm ³ /s)	Area of enclosed space below grade, A_B (cm ²)	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D_{vz}^{eff} (cm ² /s)	Capillary zone effective diffusion coefficient, D_{cz}^{eff} (cm ² /s)	Total overall effective diffusion coefficient, D_T^{eff} (cm ² /s)
1.69E+04	1.00E+06	4.00E-04	15	8,458	7.29E-03	3.05E-01	1.78E-04	1.28E-02	5.08E-04	1.11E-02

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m ³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm ³ /s)	Crack effective diffusion coefficient, D_{crack}^{eff} (cm ² /s)	Area of crack, A_{crack} (cm ²)	Exponent of equivalent foundation Peclet number, $\exp(Pe)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m ³)	Unit risk factor, URF (µg/m ³) ⁻¹	Reference conc., R/C (mg/m ³)
2685	15	3.05E+02	0.10	4.17E+00	1.28E-02	4.00E+02	3.49E+03	1.22E-04	3.73E-02	1.1E-04	4.0E-02

RESULT SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
7.38E+01	1.39E+03	7.38E+01	1.47E+06	7.38E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:

MESSAGE: The values of C_{source} and C_{building} on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

END

DATA SHEET

GW-SCREEN
Version 3.0; 04/03

Reset to
Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES ☒ X
OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES ☐

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_w ($\mu\text{g/L}$)	Chemical
79016		Trichloroethylene

MORE
↓

ENTER Depth below grade to bottom of enclosed space floor, L_f (cm)	ENTER Depth below grade to water table, L_{wt} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_s ($^{\circ}\text{C}$)	ENTER Average vapor flow rate into bldg (Leave blank to calculate) Q_{soil} (L/m)
15	2700	S	18	0.25

MORE
↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type Lookup Soil Parameters	ENTER Vadose zone soil dry bulk density, ρ_b^v (g/cm^3)	ENTER Vadose zone soil total porosity, n^v (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^v (cm^3/cm^3)
SL			SL	1.62	0.387	0.103

one soil
type used to
represent vadose zone

MORE
↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_c (yrs)	ENTER Averaging time for noncarcinogens, AT_{nc} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-04	1	70	30	30	350

Used to calculate risk-based
groundwater concentration.

CHEMICAL PRIORITIES SHEET

ABC										
Diffusivity in air, D_a (cm ² /s)	Diffusivity in water, D_w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m ³ /mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m ³) ⁻¹	Reference conc., R/C (mg/m ³)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	4.0E-02
END										

INTERMEDIATED CALCULATION SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm ³ /cm ³)	Vadose zone effective total fluid saturation, S_{te} (cm ³ /cm ³)	Vadose zone soil intrinsic permeability, k_i (cm ²)	Vadose zone soil relative air permeability, k_{rg} (cm ²)	Vadose zone soil effective vapor permeability, k_v (cm ²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm ³ /cm ³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm ³ /cm ³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm ³ /cm ³)	Floor-wall seam perimeter, X_{crack} (cm)
2685	0.284	0.184	6.01E-09	0.901	5.42E-09	17.05	0.387	0.134	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm ³ /s)	Area of enclosed space below grade, A_B (cm ²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D_v^{eff} (cm ² /s)	Capillary zone effective diffusion coefficient, D_{cz}^{eff} (cm ² /s)	Total overall effective diffusion coefficient, D_T^{eff} (cm ² /s)
1.69E+04	1.00E+06	4.00E-04	15	8,458	7.29E-03	3.05E-01	1.78E-04	7.98E-03	6.52E-04	7.44E-03

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m ³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm ³ /s)	Crack effective diffusion coefficient, D_{crack} (cm ² /s)	Area of crack, A_{crack} (cm ²)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m ³)	Unit risk factor, URF (µg/m ³) ⁻¹	Reference conc., RfC (mg/m ³)
2685	15	3.05E+02	0.10	4.17E+00	7.98E-03	4.00E+02	4.70E+05	9.83E-05	3.00E-02	1.1E-04	4.0E-02

RESULT SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
7.38E+01	1.39E+03	7.38E+01	1.47E+06	7.38E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:

MESSAGE: The values of C_{source} and C_{building} on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

END

DATA SHEET

GW-ADV
Version 3.0; 02/03

Reset to
Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES

X

ENTER Chemical CAS No. (numbers only, no dashes)		ENTER Initial groundwater conc., C_w ($\mu\text{g/L}$)									
79016		2.40E+02		<div>measured groundwater concentration</div> <div>Chemical</div> <div>Trichloroethylene</div>							
ENTER Average soil/ groundwater temperature, T_s ($^{\circ}\text{C}$)	ENTER Depth below grade to bottom of enclosed space floor, L_f (cm)	ENTER Depth below grade to water table, L_{wt} (cm)	ENTER Totals must add up to value of L_{wt} (cell G28) ENTER Thickness of soil stratum A, h_A (cm) ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm) ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)			ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability) OR ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)			
17.8	15	2700	975	1370	355	C	S	SL			

MORE
↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SL	1.62	0.387	0.103	LS	1.62	0.39	0.076	S	1.66	0.375	0.054

MORE
↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{vib} (L/m)
10	40	1000	1000	244	0.1	0.25	5

MORE
↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-04	1
Used to calculate risk-based groundwater concentration.					

END

three soil types used
to represent vadose
zone

CHEMICAL PRIORITIES SHEET

Diffusivity in air, D_a (cm ² /s)	Diffusivity in water, D_w (cm ² /s)	Henry's law constant at reference temperature, H (atm-m ³ /mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm ³ /g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF (µg/m ³) ⁻¹	Reference conc., R/C (mg/m ³)
---	---	---	---	---	--	---	--	--	--	--

7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	4.0E-02
----------	----------	----------	----	-------	--------	--------	----------	----------	---------	---------

END

INTERMEDIATE CALCULATION SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm ³ /cm ³)	Stratum B soil air-filled porosity, θ_a^B (cm ³ /cm ³)	Stratum C soil air-filled porosity, θ_a^C (cm ³ /cm ³)	Stratum A effective total fluid saturation, S_{te} (cm ³ /cm ³)	Stratum A soil intrinsic permeability, k_i (cm ²)	Stratum A soil relative air permeability, k_{rg} (cm ²)	Stratum A soil effective vapor permeability, k_v (cm ²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm ³ /cm ³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm ³ /cm ³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm ³ /cm ³)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	2685	0.284	0.314	0.321	0.184	6.01E-09	0.901	5.42E-09	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm ³ /s)	Area of enclosed space below grade, A_B (cm ²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D_A^{eff} (cm ² /s)	Stratum B effective diffusion coefficient, D_B^{eff} (cm ² /s)	Stratum C effective diffusion coefficient, D_C^{eff} (cm ² /s)	Capillary zone effective diffusion coefficient, D_{cz}^{eff} (cm ² /s)	Total overall effective diffusion coefficient, D_T^{eff} (cm ² /s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,460	7.22E-03	3.02E-01	1.78E-04	7.98E-03	1.10E-02	1.28E-02	5.08E-04	8.80E-03	2685

Convection path length, L_p (cm)	Source vapor conc., C_{source} (µg/m ³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm ³ /s)	Crack effective diffusion coefficient, D^{crack} (cm ² /s)	Area of crack, A_{crack} (cm ²)	Exponent of equivalent foundation Peclet number, $\exp(Pe)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m ³)	Unit risk factor, URF (µg/m ³) ⁻¹	Reference conc., R/C (mg/m ³)
15	7.25E+04	0.10	8.33E+01	7.98E-03	4.00E+02	2.78E+113	1.97E-04	1.43E+01	1.1E-04	4.0E-02

END

RESULT SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	1.47E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
6.5E-04	3.4E-01

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL
DOWN
TO "END"

END

MONTGOMERY WATSON		Spring ID: EW-1A/Bu	Well ID: EW-1A/Bu
Borehole Diameter: 13.40	Cy. Bit Diameter: 12.30	Project: MAFB	
Total Depth: 120.00	Gravel Elev: 79.37	Job #: 1238107.02467628	Site: Main Base/SAC
Well Comp. Date: 08-04-1999	Comp. Time: 18.30	Logged By: Todd Daniels	Reviewed By: Eric Anderson
Soil Backfill Date:	Backfill Time:	Drilling Contractor: Water Development Corp.	Field Instrumentation:
Depth to 1st H ₂ O: 80.00	Date Time: 08-04-1999 09:23	Drill Rig Type Method: ARCH	
Depth to H ₂ O After Drilling:	Date Time:	Driller's Name: Khvis Richey	
Depth to other Water Bearing Zones:		Drill Start Date: 08-03-1999	Start Time: 14:10
Samplers for Soil:	Water:	Drill Finish Date: 08-04-1999	Finish Time: 09:45

Sample Interval	Recovery (%)	Flow Count 1	Flow Count 2	Flow Count 3	Soil Sample	Water Sample	Vial Sample	PEROVA (ppm)	Initial/Static Water Level	Depth (ft)	USCS/ASTM Soil Classification	Soil Description	Color (Munsell)	% Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Silt/Clay
											ML	Gravelly Silt, light brown, dry, medium stiff to stiff, subangular to subrounded gravel to 1.0".	7.5Y 5/4	10			10	80
										5'		Increased clay content, 10-20% clay at 5'.						
										10'		Becomes Clayey Silt/Sandy Silt, brown (7.5YR 4/6), very stiff, moderately cemented, clay nodules, 5% gravel, 20% very fine sand, 75% silt/clay.						
										15'		Increasing very fine sand, decreasing clay, mica, minor gravel, 5% gravel, 40% very fine sand, 55% silt/clay.						
										14'		Driller says gravel encountered at 14'.						
										GP		Gravel with Sand, brown, very dense, dry, minor fines, subangular to subrounded pea size gravel, coarse sand.		80	15		5	
										16'		Rig chatter, hard drilling.						
										17'		Fines increase to 20% at 22'.						
										18'		Fines decreasing to 10% at 24'.						
										19'		Driller says large gravels at 26', cuttings show subangular to subrounded volcanic greenstone, minor granite.						
										20'		Gravels continue, very hard drilling, rig chatter, Rig chatter stops, driller says easy drilling at 22'.						
										SM		Clayey Silty Sand, yellow-brown, moist, very fine micaceous sand, trace medium sand.	10YR 5/6		5	60	35	
										21'								
										22'								
										23'								
										24'								
										25'								
										26'								
										27'								
										28'								
										29'								
										30'								

MONTGOMERY WATSON		Boring ID: EW-1A/Bu		Well: EW-1A/Bu														
Borehole Diam (in): 13.40		Drill Bit Diam (in): 12.30		Project: MAFB														
Total Depth (ft): 120.00		Grnd Surf Elev: 79.37		Job #: 1238107.02487628														
				Site: Main Base SAC														
Sample Interval	Recovered (%)	Blow Count 1	Blow Count 2	Blow Count 3	Soil Sample	Water Sample	Vapor Sample	PID/GVA (ppm)	Initial Static Water Level	Depth (ft)	USCS/ASTM Soil Classification	Soil Description	Color (Munsell)	% Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Silt/Clay
												Increased sand content, sand nodules moderately cemented, 10% medium sand, 70% fine sand, 20% silt/clay.						
											SP	Sand, yellow-brown, medium dense to dense, very fine to fine micaceous sand, trace subrounded gravel to 0.3", minor fines.	10YR 5/6	5			80	15
												Driller says increased gravel at 55'.						
												Becomes brown, 10% gravel to 0.5", 5% coarse sand, 5% medium sand, 60% fine sand, 20% silt/clay.						
												Increased coarse sand at 75', 10% gravel, 20% coarse sand, 50% fine sand, 20% silt/clay.						
											SW	Gravelly Sand, brown, medium to coarse sand, minor fines, subangular to subrounded quartz and volcanic gravel to 0.5".		30	30	10	10	10
												GW/GM Well graded Gravel with minor Silt, yellow-brown, dense to very dense, subangular to subrounded volcanic gravel to 1.5", minor quartz gravel, fine to coarse micaceous sand.	10YR 5/6	60	10	10	10	10

MONTGOMERY WATSON										Boring ID	EW-1A/Bu		Well ID	EW-1A/Bu				
Borehole Diam (in)		12.40		Drill Bit Diam (in)		12.38		Project		MAFB								
Total Depth (ft)		120.00		Grid Surf Elev		79.37		Job #		1238107.02467628		Site		Main Base/SAC				
Sample Interval	Recovered (%)	Blow Count 1	Blow Count 2	Blow Count 3	Soil Sample	Water Temperature	Viscosity	PI/PL/VA (ppm)	In situ Static Water Level	Depth (ft)	USCS/ASTM Soil Classification	Soil Description	Color (Munsell)	% Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Silt/Clay
												Easy drilling.						
											SC	Clayey Sand, yellow-brown, predominantly very fine sand, minor subangular to subrounded gravel to 0.5".	10YR 5/6	10	10		40	40
											GM	Silty Sandy Gravel, brown, medium dense, fine to coarse sand, subangular to subrounded quartz and volcanic gravel to 0.75".		60	10	10	10	10
											SW	Sand, fine to coarse micaceous sand, minor subangular to subrounded gravel, minor fines.		10	25	30	25	10
												Rig chatter at 115'.						
											GW	Sandy Gravel, brown, subrounded to subangular gravel to 1.5", fine to coarse sand.		60	10	10	10	10
												Total depth of boring 120'.						



MONTGOMERY WATSON

Boeing ID: EW-1A/Bu

EW-1A/Bu

Bonetole Diam. (in): 13.40

Print Edit Close 12:30

Printed: MAFB

Total Depth(ft): 120.00

Grnd Surf Elev. 79.37

Job #: 1238107/02487628

See Main Base SAC

LEGEND

[illegible]

Notes:

List of Samples

Sample ID:
EN-1A-BU-100GW

Top
100.00

120.00

Type
Analytical

Water

2000年12月

Mather Five-Year Review

Appendix B

Response to Comments

on the

Draft Report

AFCEE Comments (note, comments from Mark Rodriguez are identified with MR-; comments from Jon Atkinson are identified JA-)

AFCEE MR-1: Overall, the subject document does follow the Five-Year Review Report format accordingly. However, the cleanup standards described throughout the document (i.e., page 2-8, section 2.3.3, Table 5) should provide appropriate references and footnotes for the cleanup standard (Records of Decision, drinking water Maximum Contaminant Level, Environmental Protection Agency Region IX Preliminary Remediation Goals, Office of Environmental Health Hazard Assessment Goals, etc). In addition, the presentation of the cleanup standards in Table 5 of the report should include detection limits as applies for each contaminant and media. For example, the polyaromatic hydrocarbon cleanup standards in Table 5 are set at 330 parts per billion (ppb) that probably represent the quantitation limit in soil and not necessarily risk-based concentrations which is fine if agreed by all parties. In reviewing the California Office of Environmental Health Hazard Assessment Public Health Goals as of October 9, 2003 (www.oehha.ca.gov/water/phg/allphgs.html) there are various changes in public health goals that should be reviewed for application in this document. For example, Table 8 in the report states that the benzene California water public health goal is 0.5 ppb while the website October 9, 2003 public health goal for benzene is 0.15 (ug/l) ppb. Recommend making appropriate changes throughout the draft five-year report.

Comment response: All the cleanup standards are established by a record of decision (ROD). The four sites in the Supplemental Basewide Operable Unit which remain to be addressed by a ROD are only covered by the review for information purposes. Some of the RODs list a reference for the source of the cleanup standard (called 'cleanup levels' in the RODs) some do not. The cleanup levels in the RODs were agreed upon by the parties to the Mather Federal Facility Agreement after solicitation of public comment. The five-year review process solicited from the regulatory RPMs changes in standards or risk factors that should be specifically addressed in the review; the sole standard identified was a proposed risk factor for TCE, which was evaluated in the review. To address this comment, text is added to the header of Table 5 to state that the cleanup levels are from the records of decision, and the public health goal for benzene has been corrected in Table 8. No text has been added to address PAHs, but it should be noted that PAHs cleanup levels were based upon the practical quantitation limit at the time of the ROD for the Soil Operable Unit sites.

AFCEE MR-2: On page 7-2, section 7.1.2 please correct the fourth paragraph, 12th line from "almost all risk estimates for the cleanup levels lie within or **blow** this range" to "almost all risk estimates for the cleanup lie within or **below** this range."

Comment response: The text has been changed as requested.

AFCEE MR-3: Recommend that the discussion of the collection of indoor air samples or shallow air gas samples in Section 8, third paragraph and Section 9 indoor air risk, 9.1.1 should provide more details on measuring the trichloroethylene concentrations in indoor air or shallow soil gas since time and number of samples not provided in the report. In

addition, section 9.1.1 recommendation for the development of a sampling strategy by the regulators and implemented by the Air Force statement should be reviewed and evaluation for correction by Mather program managers since this statement implies that the regulators are in charge of the sampling strategy rather than the Air Force. Recommend stating that a sampling strategy will be developed by the Air Force with concurrence from the regulators or another version, a sampling strategy will be developed by a team composed of Air Force, regulators, and interested parties.

Comment response: The text has been changed as requested. It was not intended that the text state the sampling strategy would be developed by the regulators, but that the regulators participate in developing a sampling strategy to ensure that the concern raised by U.S. EPA during the review is addressed by the sampling strategy.

AFCEE JA-1: Title Page: Suggest referring to closed Mather AFB as Former Mather AFB.

Comment response: The use of the term "Former Mather AFB" throughout documents has proven cumbersome. For the last several years, the term has been introduced in most documents as "Former Mather AFB (Mather)" and the term "Mather" used thereafter. This practice has been followed here for consistency.

AFCEE JA-2: Page 1-5, Table 1: Suggest placing this lengthy table at the end of Section 1.

Comment response: Table 1 has been moved as suggested.

AFCEE JA-3: Page 1-13, Sec 1.4, Line 2: "Pollution" should be changed to "Pollutant."

Comment response: The text has been changed as requested.

AFCEE JA-4: Page 2-2, Sec 2.2, Para 1: Recommend using IRP site-naming convention as presented in Table 1 when referring to sites WP-12, ST-25, ST-30, and ST-47. This comment refers to the text.

Comment response: The text has been changed as requested.

AFCEE JA-5: Page 2-4, Fig 2: The specifications for the bar scale are only marginally legible. Suggest enhancing the legibility

Comment response: Figure 2 has been replaced with more up-to-date maps.

AFCEE JA-6: Page 2-5, Sec 2.3, Para 1: See comment 4.

Comment response: See response to Comment AFCEE JA-4.

AFCEE JA-7: Page 2-7, Sec 2.3.2, Para 1:

a. Suggest revising the heading to read: "Site WP-07 Plume."

b. Recommend depicting and labeling this plume on Figure 2.

Comment Response: In response to (a), the text has been changed as suggested. In response to (b), Figure 2 has been replaced with more up to date maps that include the 7100 Area (Site WP-07) Plume.

AFCEE JA-8: Page 2-8, Sec 2.3.3, Para 2, Sent 1: Should "long-term groundwater modeling" read "long-term groundwater monitoring" or "long-term groundwater monitoring and modeling"?

Comment response: The text has been correct to read, "long-term groundwater monitoring."

AFCEE JA-9: Page 2-9, Sec 2.4.1: Suggest revising the heading to read: "IRP Sites WP-07 and FT-11."

Comment response: The text has been changed as requested.

AFCEE JA-10: Page 2-10, Sec 2.4.2, Para 3, Sent 1: To correct subject-verb agreement, suggest changing "was successfully excavated" to "were successfully excavated "

Comment response: The text has been changed as requested.

AFCEE JA-11: Page 2-13, Sec 2.4.5: Suggest revising the heading to read: "IRP Sites ST-37, ST-39, and SS-54."

Comment response: The text has been changed as requested.

AFCEE JA-12: Page 2-18, Sec 2.5, Para 1, Sent 1: Suggest revising the sentence to be compatible with the fact that the Air Force was created in 1947.

Comment response: The text has been changed as requested.

AFCEE JA-13: Page 2-23, Sec 2.6.1: Suggest revising the heading to read: "IRP Sites FT-10C and ST-68."

Comment response: The text has been changed as requested.

AFCEE JA-14: Page 2-24, Sec 2.6.2: Suggest revising the heading to read: "IRP Site LF-18."

Comment response: The text has been changed as requested.

AFCEE JA-15: Page 2-25, Sec 2.6.4: Suggest revising the heading to read: "IRP Site OT-86."

Comment response: The inconsistency of site symbols between Table 1 and text in Section 2 has been corrected.

AFCEE JA-16: Page 2-25, Sec 2.6.5: Suggest revising the heading to read: "IRP Site OT-87."

Comment response: The inconsistency of site symbols between Table 1 and text in Section 2 has been corrected.

AFCEE JA-17: Page 2-26, Sec 2.7.1: Suggest revising the heading to read: "IRP Site SD-80."

Comment response: The text has been changed as requested.

AFCEE JA-18: Page 2-27, Sec 2.7.2: Suggest revising the heading to read: "IRP Site SD-85."

Comment response: The text has been changed as requested.

AFCEE JA-19: Page 2-27, Sec 2.7.3: Suggest revising the heading to read: "IRP Site SD-88."

Comment response: The text has been changed to reflect the site name as DD-88.

AFCEE JA-20: Page 3-1, Sec 3.1, Para 3, Line 8: To eliminate redundancy, suggest deleting "groundwater."

Comment response: The text has been changed as suggested.

AFCEE JA-21: Page 5-4, Sec 5.3.1.2, Para 2: Suggest adding literature citations for the screening models GW-CREEN and GW-ADV, and adding these citations to Section 11.

Comment response: The text has been changed as requested. The source of the models was the EPA website:http://www.epa.gov/superfund/programs/risk/airmodel/johnson_ettinger.htm

AFCEE JA-22: Page 6-3, Sec 6.6, Sent 2 and Sec 6.7, Line 4: A name and affiliation should be provided for "the author."

Comment response: The text has been changed as requested.

AFCEE JA-23: Page 7-6, Sec 7.2.3, Para 3: Recommend adding a figure depicting cited wells EW-5 and PZ-5 and other site extraction, injection and monitoring wells and the boundaries of the AC&W Plume. This will enhance the reader's understanding of the text.

Comment response: Figure 2 now shows the locations of all groundwater wells; the figure has been referenced in the text as recommended.

AFCEE JA-24: Page 7-7, Sec 7.2.3, Para 1, Line 10: Suggest changing "was replace" by "was replaced."

Comment response: The text has been changed as requested.

AFCEE JA-25: Page 7-10, Sec 7.3.1.2, Para 2: Suggest stating criteria for terminating operation of the pump-and-treat system and associated long-term monitoring.

Comment response: Formal criteria have not been developed. Absent other agreement, it is anticipated that existing DoD, U.S. EPA, and California regulatory guidance will be considered by the Air Force in developing any proposal to terminate operation of the pump-and-treat system and associated long-term monitoring. The text remains unchanged in response to this suggestion.

AFCEE JA-26: Page 7-10, Sec 7.3.1.3, Para 2, Sent 2: This sentence is incomplete and needs revision.

Comment response: The text has been revised to correct this mistake.

AFCEE JA-27: Page 7-11, Sec 7.3.1.3, Para 2, Sent 1: Suggest inserting "former" in front of "Mather."

Comment response: "Mather Air Force Base" has been changed to "Mather".

AFCEE JA-28: Page 7-12, Sec 7.3.1.4, Para 3, Sent 1: Suggest adding a figure depicting the Mars Way well, other nearby water-supply wells and monitoring wells.

Comment response: Figure 2 has been replaced by up-to-date plume maps; a reference to one of the maps showing the Mars Way well and other wells has been added to the text in the first paragraph of this section.

AFCEE JA-29: Page 7-14, Sec 7.3.2.2:

a Para 1, Sent 2: Suggest citing the analytes that comprise monitored "general minerals."

b Para 2: Suggest stating criteria for terminating operation of the pump-and-treat system and associated long-term monitoring.

Comment response: In response to (a) the term "general minerals" has been augmented by a list of specific constituents. In response to (b), see the response to Comment AFCEE JA-25.

AFCEE JA-30: Page 7-16, Sec 7.3.3.2, Para 3, Sent 2:

a To achieve proper terminology, suggest revising as follows: "However, groundwater flows toward this ..."

b Suggest adding a figure depicting well MAFB-109 and other monitoring wells associated with the Northeast Plume.

Comment response: In response to (a) the text has been modified to correct the terminology. In response to (b), Figure 2 has been replaced by up-to-date plume maps; a reference to Figure 2 showing the Northeast Plume monitoring wells has been added to the text.

AFCEE JA-31: Page 7-18, Sec 7.3.3.2:

a Sent 1: Suggest changing "Figure 1" to "Figure 3."

b Fig 3: Recommend revising the title as follows: "Total VOC concentrations for NE Plume, 1993 through 2002."

Comment response: The figure has been removed from the report in favor of reference to plume maps in figures 7 and 8.

AFCEE JA-32: Page 7-24, Sec 7.4.1.3, Para 2, Line 19: Suggest adding a figure depicting cited wells 7-MP-5, 7-MP-11 and other Sites 7 and 11 monitoring wells.

Comment response: A new figure has been added showing the locations of monitoring points for Site 7/11.

AFCEE JA-33: Page 7-26, Sec 7.4.2.2, Item C: No response is provided; one should be added.

Comment response: A response has been added to correct this mistake.

AFCEE JA-34: Page 7-26, Sec 7.4.2.3, Para 2, Sent 3: Suggest deleting the second "In. "

Comment response: The text has been changed as requested.

AFCEE JA-35: Page 7-36, Sec 7.5.2.3, Para 2: Recommend stating the criteria to terminate long-term groundwater monitoring and the time frame for closing the site.

Comment response: The long-term groundwater monitoring is required by ARAR. The text has been modified to add language from ARAR addressing termination of monitoring.

AFCEE JA-36: Page 7-38, Sec 7.5.3.3, Para 1, Last Sent: Recommend stating the criteria to terminate long-term groundwater monitoring at LF-04.

Comment response: The long-term groundwater monitoring is required by ARAR. The text has been modified to add language from ARAR addressing termination of monitoring.

AFCEE JA-37: Page 7-47, Sec 7.7, Sent 1: Suggest replacing "Base Conversion Agency" with "Real Property Agency."

Comment response: The text has been changed as requested.

AFCEE JA-38: Page 8-1, Sec 8.0, Para 3, Sent 2: Recommend citing the computer code used for the model simulation prediction.

Comment response: The text has been changed as requested.

RAB Comments

General Comments:

RAB 1: Because AC&W cleanup continues to periodically detect high concentrations of TCE, it is conceivable that extracted water could contain State Implementation Policy (SIP) constituents of concern (COCs) or Mather COC byproducts (i.e., phthalates, perchlorate, or any number of unmonitored constituents). Because the SIP is a statewide policy, after the Air Force evaluates whether to make a recommendation for monitoring SIP COCs, we recommend immediate monitoring for those constituents posing the most concern to assess the protectiveness of discharge into the lake. It is also conceivable that should the Air Force be discharging SIP COCs into the lake, concentrations could accumulate. We also recommend that the Air Force include National Pollution Discharge Elimination System (NPDES) updates as Applicable or Relevant and Appropriate Requirements. Individuals do fish in the lake, and it is state policy to protect human health by providing contaminant free fish. It would appear to be of Air Force interest to clear itself from this issue.

Comment response: The presence of TCE is well documented at the AC&W site. Groundwater, soil, and soil vapor have been investigated to determine whether related chlorinated organic contaminants are present with the TCE; there have been only sporadic detections at extremely low concentrations. In addition, the site was investigated for fuel constituents because there were storage tanks at the site, and PCBs, which could have been in transformer oil reportedly disposed of at the site. Groundwater was also tested for metals, pesticides, semivolatiles, phenols, and lead. The only contaminant of concern identified in the Feasibility Study was TCE. Under CERCLA, changes in regulations are evaluated to see if adopting the changes is necessary for the remedy to be protective of human health and the environment. The five-year review concludes that the changes in the NPDES regulations do not call into question the protectiveness of the remedy.

RAB 2: The RAB continues to be concerned about the perpetual tracking and financing of land use covenants. There are no means of guaranteeing the enforceability of existing and future land use covenants. The RAB encourages the Air Force to amend the Supplemental Basewide Operable Unit Record of Decision to transfer institutional control enforcement to the State and finance tracking mechanisms as long as needed to ensure the community is adequately protected once the Air Force is no longer present on base. Financing a state system for tracking and enforcing land use requirements decreases Air Force responsibilities for tracking all land use requirements throughout the U.S. It is reasonable to assume that the greater number of bases that require tracking, the more difficult it would be for the Air Force (given current priorities) to provide adequate protection.

Comment response: This comment addresses the dispute between the Air Force and the State regarding institutional controls in the Supplemental Basewide Operable Unit Record of Decision. None of the parties in the dispute advocates that the Air Force give up any responsibility for implementing, monitoring, and enforcing land use restrictions at Mather.

The use of land-use covenants by the State creates an additional monitoring and enforcement mechanism. The concept of the Air Force divesting its responsibility for managing land-use restrictions to the states is beyond the scope of the Mather five-year review.

RAB 3: Because the objectives for the Five Year Review include assessing whether exposure assumptions, toxicity data, cleanup levels, and remediation action objectives are still valid and protective of human health and the environment, the RAB highly encourages the Air Force to incorporate the TCE cancer risk slope factor discussed in the Five Year Review into evaluating overall protectiveness of remedial actions. This factor decreases the risk of cancer to 173 people out of a million (compared to the original preliminary remediation goal). One of these people could be a family member. It is understood that the PCE cancer risk slope factor discussed in the Five Year Review increases cancer risk by 75 people per million. The RAB does not encourage the Air Force to incorporate this information into the evaluation. It is also understood that there are many assumptions involved in all clean up decisions, and we encourage conservative use of protective science.

Comment response: The cancer risk slope factors are estimates of the relationship between exposure (i.e. dose) to a contaminant and the resulting incidence of cancer. The use of one factor over another does not change the actual risk, only the estimate of that risk. The five-year review evaluated and compared risk estimates resulting from the use of two cancerslope factors each for TCE and PCE, which are the slope factors advocated by the State and U.S. EPA.

RAB 4: As a community advisory group, we continue to express concern over plume migration into the neighborhoods that pump their water directly from ground to faucet. Numerous times we've requested resolution of the Contingency Plan dispute, should it be needful to shut off wells that jeopardize water supply. Plume migration continues to threaten the municipal water supply, and we continue to request hydraulic containment and control of the Main Base/SAC plume. The RAB highly encourages the Air Force to not only decrease contaminant levels, but also decrease migration into the Rosemont and Lincoln Village neighborhoods. Factoring in the TCE cancer risk slope into trigger levels may increase the effort at hydraulic control and reduce the chance of inhibiting water supply to neighborhoods during an Air Force vs. state dispute.

Comment response: The Air Force, U.S. EPA, and State continue to hold protection of drinking water as a top priority of the cleanup program. The 1998 Contingency Plan continues to be in force until it is replaced with a revised plan. It should be noted that the extent of the TCE plume is less than that of the PCE and carbon tetrachloride plumes, and that the five-year review evaluated current slope factors adopted by both U.S. EPA and the State to assess the protectiveness of the aquifer cleanup levels established in the records of decision. Trigger levels are established by the Contingency Plan for TCE, PCE, and carbon

tetrachloride, at one half of the aquifer cleanup levels, and are therefore twice as protective that the aquifer cleanup levels.

RAB 5: There have been detections of perchlorate in the Main Base/SAC effluent. Detections are most distressing, as the Air Force may be discharging perchlorate back into the aquifer. The RAB encourages close monitoring and preliminary discussions on how to protect the neighborhoods from spreading perchlorate, on how to protect the water supply, and how to protect the Air Force against liability.

Comment response: The Air Force continues to monitor the Main Base/SAC effluent for perchlorate. After low concentrations began to be detected in 2003, successively more widespread sampling was conducted to determine the source of the perchlorate entering the treatment plant. The sampling has detected low concentrations of perchlorate (most less than 1 ug/L, and none greater than 2 ug/L) in all the extraction wells, a pattern that does not match a pattern expected from any specific source (such a pattern would be expected to show some higher concentrations nearer to the source, and lower further from the source). The California public health goal for perchlorate is 6 ug/L. The monitoring data indicate that the Mather treatment system is drawing in about 1 ug/L from throughout the Main Base/SAC Area Plume, and then injecting about the same concentration of perchlorate near the edge of the perchlorate plume. The Air Force and regulatory agencies are watching this situation closely and will continue to ensure that adequate monitoring occurs to support decisions so that the Mather treatment system does not spread perchlorate.

RAB 6: The uncertainty associated with the Northeast Plume calls into question the protectiveness of its remedial action. The cause of the uncertainty in assessing plume boundaries and sources may be due to the Air Force waiting for development to install monitoring wells. Monitoring is rarely contingent on development. The RAB suggests proposing areas for monitoring well locations and identifying processes for installation. It is our understanding that this plume was benign, and now this assumption is being drawn into question. The problem is becoming more apparent, and awaiting another 5 year review sequence to begin action is unacceptable. The area may require land use restrictions.

Comment response: The degree of uncertainty in identifying plume boundaries of the Northeast Plume has not any greater than in the past. New wells have decreased uncertainty as to depth and downgradient extent, but wells are still needed just to the north of Mather. The Air Force still plans to install wells to the north in 2005, once roads are constructed to allow access to these areas. The five-year review documents that the area of the plume with concentrations at or above the drinking water standard concentrations has become less over the last five years; or in other words, concentrations over much of the plume have become lower. Land-use restrictions have been in place through the airport lease since 1993.

RAB 7: The RAB encourages full follow through and removal of dissolved phase liquids in perched water at Site 7. Please include more information on this area in the Five Year Review.

Comment response: The text has been revised to address this comment. An attempt to dewater the perched zone was proposed in 2003 and is funded in 2004. There is no guarantee that removal of all perched water with dissolved-phase contaminants is possible or practical, because the rate of replenishment of the perched zone is not yet known. However, the dewatering effort will allow an assessment of what can be accomplished by pumping from the perched zone. At a minimum, some contamination will be removed with the water, and by lowering the level of perched water, more contamination will be exposed for removal by the soil vapor extraction system.

RAB 8: Please include more discussion and verification in the text about why contaminants not identified in the ROD were not of concern when terminating treatment at Site 60. What standards were used to determine the constituents posed no threat?

Comment response: The contaminants that still were detected when Site SD-60 was evaluated for closure were all evaluated for threat to water quality using vadose-zone modeling as described in the remedial action report (Montgomery Watson, 2001n). These contaminants included some that were not identified in the ROD as contaminants of concern. Vadose zone modeling using Vapour T indicated that the residual trace concentrations of contaminants did not pose a significant threat to water quality.

RAB 9: The RAB requests a discussion of incidentally identified constituents before the Air Force terminates SVE treatment at Site 10C/68.

Comment response: The SVE termination process for Site FT-10C and Site ST-68 is governed by the Basewide OU ROD (AFBCA, 1998b) and the Site Closure Process Evaluation, Revision 1 (MWH, 2002c), which requires that all data be evaluated. The evaluation will be available for review by the RAB and a presentation will be given to the RAB at that time with an opportunity for discussion.

RWQCB Comments

The Draft Review is well organized and provides a summary and evaluation of the status and performance of remedial actions conducted at former Mather AFB. Regional Board and DTSC staff find that in some cases, the information is too general, and the Draft Review lacks adequate data evaluation to determine whether or not the remedial actions remain protective of human health and the environment. The Draft Review should be revised to include more specific technical data evaluation to support conclusions regarding the performance and protectiveness of remedies, or additional recommendations to provide sufficient data, as discussed in detail below.

RWQCB 1. Additional Contaminants of Concern (CoCs): Our comments during past five-year review processes addressed identification and cleanup of additional CoCs that are detected during soil vapor extraction (SVE), and are not identified in the associated Record Of Decision. The Draft Review states that during SVE monitoring, chemicals have been detected in addition to those identified as CoCs in the decision documents. However, these chemicals do not appear to be identified in the Draft Review. The Draft Review further states that in the last five-year review the Air Force committed to treating these chemicals as potential CoCs, and evaluating any continued presence of these chemicals as part of the decision to terminate SVE at any of these sites. It is not clear how the Air Force intends to meet this commitment.

Although parts of the narrative SVE cleanup criteria were used to achieve no further action at Sites 56 and 60, we do not believe that a process for addressing additional CoCs was demonstrated at these sites. Please delete the reference to Site 56 and 60 in the context of evaluating additional CoCs. A more appropriate reference in this context would be to Site 10C/68 where a remedial decision must be developed to address lead detected in site soils not identified as a CoC and not addressed by the selected SVE remedy.

Please specify all additional chemicals detected to date, including the site identity, the selected remedy, and the operating remedy for the site, in a matrix for technical evaluation, as requested in our past five-year review comments. The Draft Review should also be revised to incorporate general procedures to address cleanup levels or other components of a remedy should any additional CoCs be identified that are not compatible with the SVE remedy and SVE termination process.

Comment response: The SVE termination process for all systems currently running under CERCLA authority is governed by requirements in either the Soils OU ROD (AFBCA, 1996) or the Basewide OU ROD (AFBCA, 1998) and the Site Closure Process Evaluation, Revision 1 (MWH, 2002c), which requires that all data be evaluated. The closure process for sites 56 and 60 evaluated all residual contaminants remaining at the time of closure for threat to water quality. This is documented in the remedial action reports for Site SD-60 and SD-56, respectively (Montgomery Watson, 2001n and 2002a). The contaminants were not formally evaluated for health risk.

RWQCB 2. Assessment of Northeast Plume Remedy. The Draft Review lacks adequate data evaluation to support the conclusion that the remedy is functioning as intended by the *1996 Final Record of Decision Soil Operable Unit Sites and Groundwater Operable Unit Plumes Groundwater Operable Unit Record of Decision* (ROD). As discussed in Section 7.3.3.2, remedial action objectives for the Northeast Plume remedy include a commitment to reassess the remedial decision if cleanup standards are predicted to require more than forty years to attain. This remedial action objective has not been met. The Air Force has not yet performed modeling, or otherwise made technical based predictions, regarding the time required to reach cleanup standards, as required pursuant to the ROD.

In March of 2002, the Air Force submitted an evaluation of the Northeast Plume remedial action entitled the *Draft Final Northeast Plume Evaluation Report*, revised and renamed from the *Draft Interim Remedial Action Report*, that was not complete and therefore does not adequately support the decision to continue monitoring as opposed to initiating active remediation. As discussed in our 19 April 2002 comments, we believe that based on the data presented in 2002, concentrations in groundwater appear to have remained relatively low with respect to ROD cleanup requirements. However, this evaluation did not include sufficient technical data to demonstrate that plume contaminants will meet cleanup levels within a reasonable time as required in the ROD. The Report showed that the nature and extent of the contaminant plume in 2002, particularly at depths below the water table was not adequately characterized. Both lateral and vertical plume migration was to be evaluated further to support continued long term monitoring versus active remediation as the selected remedy.

As a result, additional monitoring wells were installed to further monitor contaminant concentrations and transport within the Northeast Plume. The Air Force was asked to submit a follow-up report to evaluate the state of the plume and to assess remaining data gaps related to the distribution and potential migration of plume contaminants once data from these newly installed monitoring wells became available. The Draft Review includes only a brief evaluation of data from all wells sampled over the last decade.

As also discussed in our April 2002 comments on the plume evaluation report, we remain concerned that the groundwater monitoring program and the monitoring network may not be adequately designed. Because the remedial action is passive rather than active groundwater extraction and treatment, the continued long-term groundwater monitoring to assess contaminant concentrations and plume conditions is one of the main components of the selected remedy for the Northeast Plume. The Report presents only general results of groundwater monitoring from wells in the area of the plume and adjustments made since the ROD without rationale or reference to remedial action objectives or other components of a comprehensive monitoring program for the site. A sampling plan that describes the rationale for selecting particular monitoring well locations for sampling, constituents to be analyzed, and the sampling and water level measurement frequencies should be developed based on specific Long-Term Groundwater Monitoring Program objectives.

The Draft Review should be revised to include a more detailed evaluation of Northeast Plume groundwater monitoring data, and a recommendation to submit a follow-up report, to complete the analysis of the remedy as requested in our April 2002 comments, to adequately support conclusions, and to resolve issues raised during this and past five-year review processes.

Comment response: The text has been augmented by reference to new figures from the draft 2003 annual groundwater monitoring report (MWH, 2004) that was issued after the draft five-year review report was issued. The figures include time-concentration plots for selected wells, and show plume contours for PCE and DCE for 2003 compared with baseline concentrations at the start of the remedial action period. The figures document that the extent of the plume above the cleanup levels has decreased, and that concentrations in most wells have dropped in the last two years, apparently reversing the prior long-term pattern. Newly installed wells have shown that the extent of the plume above cleanup levels appears to be of limited depth. Additional monitoring wells are still needed to the north to define the extent of concentrations above the cleanup levels; these wells are planned for 2005. The latest monitoring results are documented in the 2003 annual groundwater monitoring report (MWH, 2004). A site-specific evaluation is appropriate in each annual report, and this recommendation has been added to the text.

RWQCB 3. Assessment of Aircraft Control and Warning (AC&W) Treatment System Remedy. The Draft Review does not adequately evaluate the potential risks to human health and the environment associated with the discharge of treated water to Mather Lake from the AC&W Groundwater Treatment System.

The Air Force is out of compliance with the Federal National Pollutant Discharge Elimination System (NPDES) applicable or relevant and appropriate requirement (ARAR) relevant to the CERCLA cleanup of groundwater at the AC&W Site. The Air Force has not submitted the data necessary to fully assess the AC&W Treatment System effluent and receiving water quality with respect to protectiveness of the remedy.

An effluent and receiving water study is substantively mandated under the NPDES Program, as well as, required pursuant to Waste Discharge Requirements NPDES Order Number CA0083992 adopted by the Regional Board for the Air Force AC&W Groundwater Treatment System, in order to complete a reasonable potential analyses for priority pollutants, utilizing guidance covered by the Policy for the Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP), adopted in March 2000 by the State Board. Numeric water quality criteria for priority pollutants were promulgated by U.S. EPA with the adoption of the *National Toxics Rule* (NTR) on 5 February 1993 and the *California Toxics Rule* (CTR) on 18 May 2000.

Federal regulations require effluent limitations for all pollutants that are or may be discharged at a level that will cause or have a reasonable potential to cause, or contribute to an in-stream excursion above a numerical or narrative water quality standard. All

NPDES Dischargers are required to provide information as to whether the levels of priority pollutants, including CTR and NTR constituents, and constituents for which drinking water maximum contaminant levels prescribed in the California Code of Regulations, in the discharge cause or contribute to an in stream excursion above a water quality objective. If the discharge has the reasonable potential to cause or contribute to an in-stream excursion above a water quality objective, the Discharger is required to submit information to calculate effluent limitations for those constituents.

There is inadequate information to conduct the NPDES reasonable potential analysis or to determine if the discharge to Mather Lake will comply with the anti-degradation provisions of SWRCB Resolution #68-16. The Air Force is also required to conduct a study to determine constituent levels for surface water and the effluent to determine compliance with these anti-degradation provisions.

In order to satisfy these ARARs, data must be provided to determine if there is reasonable potential for the discharge to cause or contribute to an in stream excursion above a water quality objective for any of the priority pollutants or cause degradation of surface water quality. The Air Force must provide information as to whether the levels of NTR and CTR constituents, and U.S. EPA Priority Pollutants in the discharge cause or contribute to an in-stream excursion above a water quality objective so that substantive requirement for the effluent or effluent limitations may be calculated for those constituents in the discharge that have a reasonable potential to cause or contribute to an in-stream excursion above a water quality objective.

On 10 September 2001, the Regional Board's Executive Officer issued a letter, in conformance with Section 13267 of the California Water Code, requiring all NPDES dischargers, including the Air Force, to prepare a technical report assessing water quality. Order No. CA0083992 is intended to be consistent with the requirements for the technical report, in requiring sampling for NTR, CTR, and additional constituents, to determine the full water quality impacts of the discharge. The Air Force is in violation of these technical report requirements.

The Draft Review should be revised to include a more detailed evaluation of the AC&W Treatment System effluent and receiving water quality or a recommendation to submit a technical report, as required to comply with the NPDES Program mandates, and pursuant to the anti-degradation provisions of SWRCB Resolution #68-16, to adequately support conclusions regarding the protectiveness of the AC&W remedy.

Comment response: The Air Force believes the AC&W remedy complies with the NPDES ARAR identified in the 1997 ESD (AFBCA, 1997). Subsequent changes in the regulation are not automatically adopted as ARARs, unless the remedy is found to no longer be protective of human health or the environment, and the new requirements adopted in an amended decision document. The AC&W site and associated groundwater was characterized for the suite of contaminants judged to have a reasonable potential of being present in the soil or groundwater. Analytes included VOCs, SVOCs, fuel constituents, pesticides, PCBs, and metals. The site characterization was overseen by U.S. EPA, DHS

(now DTSC), and RWQCB remedial project managers. The only contaminant of concern resulting from the investigations was TCE. In December 2003, and again in June 2004, wells screened below the AC&W plume were sampled for perchlorate. No detections were found in the December samples; the June results are not available as of the date of this report. The Air Force does not believe there is a reasonable potential for any additional contaminants to be in the groundwater entering the treatment system. The Air Force will continue to coordinate with The Boeing Company and Aerojet, and with the Mather remedial project managers, to monitor the AC&W area for encroachment of perchlorate into the capture zone of the AC&W extraction wells.

RWQCB 4. Institutional Controls. The Draft Review does not adequately address the lack of specific institutional controls in Mather Record of Decision documents. As discussed in our major comments during past five-year review processes, we believe that specific institutional controls must be identified as part of each selected remedy or no further action decision in order to adequately protect human health and the environment, and to protect components of a remedial action, in areas where waste remains in place or where environmental cleanup is ongoing.

We request that the Air Force identify each such institutional control, the objectives of the specific controls, timelines and details of implementation, including all involved parties, in a strategy or implementation plan document that is subject to the terms of the Federal Facilities Agreement, or in another enforceable document (i.e. a ROD or ROD Amendment, or other primary document). We understand that resolution of this issue is subject to the resolution of the state's dispute with the Air Force over the Mather OU-6 ROD.

Comment response: Comment noted.

SMAQMD Comments

SMAQMD 1: The SMAQMD wishes to give a comment regarding the 5 year review draft document. All contaminated soil excavation projects in Sacramento County require proposal review and approval in writing. The SMAQMD will either issue, in your case, ARARS for CERCLA sites or a permit for non-CERCLA sites or an exemption letter. The exemption letter will inform you that your project is exempt from any permitting requirements and will inform you of air quality rule applicability and requirements that you would still need to be in compliance with even though you may not be required to have ARARS or a permit. For more information about current air quality rules and regulations, please go to our website at www.airquality.org.

Comment response: Comment noted. All excavation projects that are part of CERCLA remedies have SMAQMD ARARs identified in decision documents (removal action memoranda for sites 80, 85, 88, and 89, and records of decision for all other sites). Excavation projects for non-CERCLA sites are beyond the scope of this review, but will be coordinated through the Sacramento Metropolitan Air Quality Management District.

GENERAL COMMENTS

U.S. EPA 1. The Draft Five-Year Review of Remedial Actions Conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (the Report) lacks a detailed discussion of the groundwater remedies. There is insufficient technical information to support the conclusion that the remedy is functioning as intended and is protective. Information such as capture zones and contaminant concentration trend analyses should be included to support the Air Force's conclusion that remedy is protective. Please revise the Report accordingly.

Comment response: The Report text has been revised to provide more specific information about the current status of the extraction systems and temporal trends which bear on the performance of the remedies. Figures have been added which show the interpreted capture zones of the extraction systems for the Main Base/SAC Area Plume and Aircraft Control and Warning Site Plume. The Report, however, is written to provide a summary of the information presented in other more detailed reports, and an attempt has been made to summarize and provide references for all information drawn from these other sources, as opposed to providing all supporting information in the Report.

U.S. EPA 2. Please include a completed Five-Year Review summary form, as well as the EPA ID number for Mather (CA8570024143) in the Report.

Comment response: A summary form has been added to the Report.

U.S. EPA 3. The individual Remedial Action Objectives (RAOs) Analyses presented in Section 7 should be presented as part of the answer to Question A: Is the remedy functioning as intended in the decision documents? These discussions should also be revised to include, at a minimum, pumping rates, a discussion of operations and maintenance (O&M) of the systems, the costs of systems operations, and note any of the proposals for, optimizing the remedial systems (particularly the reductive dehalogenation proposals, groundwater monitoring program revision, and passive diffusion bag sampling) and/or reducing O&M costs. Please revise the text accordingly.

Comment response: Information on pumping rates is included in each of the groundwater extraction discussions. Information on proposals for improving efficiency or effectiveness has been added where applicable. Only noteworthy operation and maintenance issues were reported during the review. Information on cost was not gathered as part of the review. One reason is that the program is managed with daily on-site presence, and uses more direct indications of efficient operation than cost fluctuations. The program focus is more on effective and efficient operation of the remedial actions to meet ROD objectives than comparing costs to estimates from the feasibility studies. The second reason is that until recently, multiple sites were contracted together, and the costs attributed to each site were not tracked. The costs per site have been estimated as part of an effort to forecast the cost

to complete remediation at each site, but this data is an estimate rather than a strict accounting.

U.S. EPA 4. The known extent of groundwater contamination shown on Figure 2 is eight years out of date. The Report should include additional figures illustrating the extent of groundwater contamination as it is currently known to exist, the locations of extraction and injection wells, estimated or measured capture zones for the extraction systems, the general groundwater flow direction, and the location of vadose zone sites and soil vapor extraction (SVE) systems relative to the known extent of groundwater contamination. A comparison of changes in groundwater plume configurations over time would also greatly enhance the discussions of the progress since the last review.

Comment response: Figure 2 has been replaced with up-to-date figures showing most information as requested, as well as references to other figures in the most up-to-date source documents. A comparison of changes in groundwater plume configurations over time is available on figures 6-2 through 6-4 of the draft 2003 annual groundwater monitoring report (MWH, 2004) and these figures have been referenced in the text.

U.S. EPA 5. Consistent with EPA guidance (EPA, 1989) risk estimates should be presented to only 1 significant figure. Use of excessive significant figures implies a degree of accuracy greater than is possible, particularly given the screening-level models used in this review to estimate exposure concentrations. Please revise the text accordingly.

Comment response: The text has been revised; in no case is the risk presented to a greater number of significant figures than the associated slope factor or other value.

U.S. EPA 6. The review should clearly identify those sites which are contaminated solely with petroleum hydrocarbons. Such sites are exempt from CERCLA and hence the requirements of a Five-Year Review and should not be included in the technical analysis for this review. Perhaps a table listing the sites and rationale for exclusion from technical evaluation would be helpful to track sites which are either Non-CERCLA, no further action (NFA), Closed, or on-going less than five-years to complete.

Comment response: Table 1 provides this information.

U.S. EPA 7. The report would benefit from a thorough editing before finalizing to correct spelling, grammatical and punctuation errors. Additionally, it would be helpful if consistent units were used when describing groundwater and soil contamination. Often, contaminant concentrations in groundwater are presented in parts per billion (ppb), micrograms per liter (ug/L) and milligrams per liter (mg/L) in the same section. Finally, the designation of Sites and Operable Units (OU) should use consistent terminology. For example, Section 2.7 discusses the Supplemental Basewide OU and refers to the Supplemental Basewide OU Record of Decision (ROD). However, Section 4.5 apparently refers to this same Operable Unit as OU-6, and Section 5.2.1 refers to the

Supplemental Basewide OU ROD as the OU-6 ROD. In addition, the site identifiers in Section 4.5 do not specifically match the identifications provided in either Section 2.7 or Table 5. Please revise the text accordingly.

Comment response: The Report has been edited to correct these discrepancies.

SPECIFIC COMMENTS

U.S. EPA 8. **Page 1-5, Table 1:** It is unclear why WP-07 is listed as requiring a policy review since it will leave waste in place and requires institutional controls to protect the cap. Please revise to a statutory review.

Comment response: The table has been corrected to indicate that the Site WP-07 landfill requires a statutory review.

U.S. EPA 9. Page 2-1, Section 2.1, Site Description and History: It is unclear whether the 129 acres of easements are part of, or in addition to the 5,845 acres stated as the size of Mather Air Force Base (AFB). Please clarify in the text..

Comment response: The text has been revised to clarify that the 129 acres of easements are included in the 5,845-acre total.

U.S. EPA 10. **Page 2-7, Section 2.3.1, Main Base/SAC Area Plume:** The discussion here notes five separate phases of the groundwater extraction system for this site, only one of which was operational at the time of the previous Five-Year Review. Please indicate on a figure, in the text, or both, which specific extraction wells were installed during each of the phases.

Comment response: The details of which wells were installed during each phase of extraction system construction is add odds with the summary information in Section 2. This information has been added to Section 7.3.1.2.

U.S. EPA 11. Page 2-8, Section 2.3.3, Northeast Plume: As defined in the ROD for this site, please revise the text in the second paragraph to note that active remediation will be considered if cleanup standards are not met within a reasonable time or 40 years from the date of the ROD.

Comment response: The text has been revised to include the information requested.

U.S. EPA 12. Page 2-9, Section 2.4.1, IRP Site 7/11: For clarification, please provide the following information:

Provide a brief description of the cap at Site 7.

Clarify whether the "remediation strategy" employed by the Air Force complies with the remedy selected in the ROD.

Provide a brief description of the in situ remediation systems for Sites 7 and 11.

Provide an estimate of the duration of the remedial action.

Comment response: The text has been revised as requested.

U.S. EPA 13. **Pages 2-24 to 2-25, Section 2.6.3, IRP Site SS-23:** Please clarify whether Site SS-23 is the same as Site OT-23 shown on Figure 1 and Table 1.

Comment response: The text has been revised to correct discrepancies in the site nomenclature.

U.S. EPA 14. **Page 2-25, Section 2.6.3, IRP Site S-23:** Please clarify what is meant by the term "reactive organic compounds."

Comment response: The text has been revised as requested.

U.S. EPA 15. Pages 3-3 to 3-9, Table 5: Cleanup Standards for Mather AFB Installation Restoration Program (IRP) Sites:

Please use consistent units in this table (i.e., surface water concentrations are presented in both ppb and ppm, while groundwater concentrations are presented in ug/L).

It is recommended that the last column be titled "remedial action objectives." Unless the remedial action objectives (RAOs) are based on a promulgated criteria (e.g., maximum contaminant levels [MCLs]) it is inaccurate to refer to them as "standards."

"Narrative" cleanup goals should be explained.

Use consistent terminology when referring to specific sites. For example, Section 2 describes Sites SS-56, DD-80, DD-85, and DD-88, while they are apparently referred to as SD-56, SD-80, SD-85, and OT-88 in Table 5.

Comment response: Table 5 presents the units as they are presented in the RODs. The heading has been changed from "cleanup standards" to "cleanup levels" as this is the term used in the RODs. The narrative cleanup goals are described in the Section 7 discussion of each site. The text has been revised as requested to correct discrepancies in site identifiers.

U.S. EPA 16. **Page 5-3, Section 5.3.1.1, Consideration of the Latest TCE Risk Estimates:** Please revise the text in this and Section 5.3.1.3 to note that the revised cancer slope factor for trichloroethene (TCE) represents a value used by EPA on a national level, not simply in Region 9. The TCE slope factor was developed by the National Center for Environmental Assessment (NCEA). Currently, provisional peer-reviewed values developed by NCEA should be used whenever values are not available in EPA's Integrated Risk Information System. Please revise accordingly.

Comment response: The text has been revised as requested.

U.S. EPA 17. **Page 5-5, Section 5.3.1.3, Calculation of Risk from Air Stripper Emissions:** This section reports that a risk assessment will be conducted for emissions from the Site 7 air stripper. Please indicate where that risk assessment will be presented, and include this recommendation in Section 9. Also, please include "MWH" in the list of acronyms, or spell out the company's name.

Comment response: The text has been revised as requested. "MWH" has been included in the list of acronyms.

U.S. EPA 18. Page 7-2, Section 7.1.2, Are the toxicity data used at the time of the remedy still valid?: The discussion in this section should focus on risk-based cleanup levels (or components of cleanup levels). Cleanup levels for groundwater were established as the contaminant-specific MCL. EPA policy states that it will not reopen remedy selection decisions contained in RODs unless a new or modified requirement calls into question the protectiveness of the selected remedy. As noted in Section 7.1.3, none of the cleanup standards established for groundwater contaminants has been revised subsequent to the ROD. Accordingly, the review should note that a review of Applicable or Relevant and Appropriate Requirements (ARARs) indicates that no new standards have been promulgated or proposed since the ROD that would call into question the protectiveness of the remedy for groundwater.

Comment response: The text has been revised as requested.

U.S. EPA 19. Page 7-9, Section 7.3.1.2, Main Base/SAC Industrial Area Plume Evaluation Questions: This section is incomplete because it does not include all the information that has come to light that could call into question the protectiveness of the remedy. This section should include, for example, a discussion of the on-going perchlorate evaluation and any potential impact of upgradient off-site perchlorate. It should also provide a more specific discussion of the continued migration of Main Base/SAC plumes to the south and southwest and discuss how the Main Base/SAC remains protective due to operating treatment systems on the downgradient water supply wells. Please revise accordingly.

Comment response: The text has been revised as requested.

U.S. EPA 19. **Page 7-9, Section 7.3.1.2, Main Base/SAC Industrial Area Plume Remedial Objectives Evaluation:** Please define the term "hot spots" and provide a description of their locations.

Comment response: The text has been revised as requested and figures added to depict locations of 'hot spots.'

U.S. EPA 20. **Page 7-9, Section 7.3.1.2, Main Base/SAC Industrial Area Plume Remedial Objectives**

Evaluation: This section notes that a least one additional phase of the Main Base/SAC Plume extraction system will be necessary to achieve the objectives of the ROD. Please identify which objectives are not being met and include the implementation of an additional phase as a recommendation and follow-up action in Section 9.

Comment response: The text has been revised as requested.

U.S. EPA 21. **Page 7-9, Section 7.3.1.2, Main Base/SAC Industrial Area Plume Remedial Objectives**

Evaluation: Please clarify whether any treatment plant effluent has exceeded discharge standards in the period covered by the current review, as it is not clear why a detection apparently exceeding discharge standards on May 11, 1998 is relevant to this review. If this detection is relevant, please clarify whether the estimated detection of total petroleum hydrocarbons reported as gasoline (TPH-g) was 10 ug/L, whether the estimated value was 10 ug/L below the laboratory reporting limit, and/or whether the laboratory reporting limit was specific to May 11, 1998.

Comment response: The text has been revised as requested. There were no exceedances during the five-year review period, but the previous exceedance was mentioned for historic perspective.

U.S. EPA 22. **Page 7-12, Section 7.3.1.4, Mather Off-base Water Supply Contingency Plan – Remedial**

Action Objectives Analysis: This section should discuss how the Contingency Plan addressed each of the eight requirements outlined in Section 7.3.1.3.

Comment response: The text in has been revised with a brief synopsis of how each requirement is addressed.

U.S. EPA 23. **Page 7-12, Section 7.3.1.4, Mather Off-base Water Supply Contingency Plan – Remedial**

Action Objectives Analysis: The text should provide information to support the conclusion that the source of TCE in the Gould Well is not associated with sources at Mather. Please revise the text accordingly and provide a figure showing the location of this well.

Comment response: The text has been revised as requested, and a figure added that shows the location of the Gould Way well and groundwater monitoring wells in relation to the nearest Mather plume.

U.S. EPA 24 **Page 7-16, Section 7.3.3.2, Northeast Groundwater Plume Remedial Action Analysis:** The first paragraph states that the County of Sacramento has revised the County Code; however, the last sentence states that the revised ordinance has not been implemented because it is not law. Please clarify the status of this revision and what additional action is necessary for it to become law.

Comment response: The text has been revised to correct this discrepancy.

U.S. EPA 25 **Page 7-16, Section 7.3.3.2, Northeast Groundwater Plume Remedial Action Analysis:** The utility of presenting the sum of all contaminant concentrations is not apparent. This value is highly dependent on the number of wells and their locations within the contaminant plume, and unless the Air Force proposes to interpret the remedial objective for the Northeast Plume in terms of an average concentration, is not related to the objectives stated in the ROD of obtaining cleanup standards throughout the contaminated aquifer. Please provide further explanation of the usefulness of this data in terms of progress towards meeting the remedial objectives, or delete the discussion.

Comment response: This presentation has been deleted as requested.

U.S. EPA 26. Page 7-17, Section 7.3.3.2, Northeast Groundwater Plume Remedial Action Analysis: Please discuss whether contaminant concentrations exceeded cleanup levels in the wells prior to their going dry.

Comment response: The text has been revised as requested.

U.S. EPA 27. Page 7-18, Section 7.3.3.2, Northeast Groundwater Plume Remedial Action Analysis: The Air Force should identify what information is needed so that predictive modeling can be relied upon to reasonably predict when cleanup levels will be achieved, and outline a plan for obtaining the requisite data as a recommendation/follow-up item in Section 9. If the Air Force does not believe that modeling can be relied upon to accurately predict the time frame needed to achieve cleanup goals, then other evaluation criteria to determine whether active remediation is warranted should be proposed.

Comment response: The text has been revised as requested.

U.S. EPA 28. Page 7-26, Section 7.4.2.2., Site 37/39/54: It appears the answer to Question C. has been inadvertently omitted.

Comment response: The text has been revised to correct this omission.

U.S. EPA 29. Page 7-28, Section 7.4.3.2, Site 56: It appears the heading for what would be Section 7.4.3.3 *Remedial Action Evaluation*, is missing. The discussion follows Question C. but has no heading..

Comment response: The text has been revised to correct this omission.

U.S. EPA 30. Page 7-35, Section 7.5.1, Evaluation of ARARs for Landfill OU Sites 3 and 4 and the Site 7 Landfill: Please delete the paragraph following Table 10 or include it in the CCR discussion on page 7-34. Currently, it reads as though there are no changes to the ARARs because it would be tedious to change them, not because there have been no new ARARs affecting the protectiveness of the remedy.

Comment response: The text has been revised to clarify this paragraph, and to avoid unintended implications.

U.S. EPA 31. **Page 9-1, Section 9.0, Recommendations and Follow-Up Actions:** For each recommendation, please include a proposed schedule for completion.

Comment response: The text has been revised to add a proposed or estimated schedule for completion.

U.S. EPA 32. **Page 9-2, Section 9.2, Next Five-Year Review:** Please revise the text in this section to state that the first Five-Year Review was completed in September 1999, and that the triggering action for that review was the start of construction of the Aircraft Control and Warning Site groundwater extraction and treatment system. The triggering action for the current review is the finalization of the previous review, and is no longer dependent on the date of initial triggering action. In addition, please note that subsequent reviews will be conducted no less frequently than every five years.

Comment response: The text has been revised as requested.

MINOR COMMENTS:

U.S. EPA 33. **Page 1, First paragraph:** The second sentence should read that the report provides "reviews required by statute," not by statue.

Comment response: The text has been revised to correct this error.

U.S. EPA 34. **Section 2.4.7, Page 2-14:** The last sentence of the second paragraph should reference the O&M Manual for the Soil Vapor Extraction System.

Comment response: The text has been revised to correct this error: The spine of the 1997 manual omitted the word "vapor" but the front slip sheet did not.

U.S. EPA 35. Sections 2.7 and 2.7.1 are repeated (pages 2-26 and 2-27). Page 7-48 appears twice, once before page 7-47 and once after.

Comment response: Comment noted. This was an error in compiling your copy of the report.

U.S. EPA 36. Correct the title of Section 3.5 to Summary of Basis for Taking Action (not bases as stated).

Comment response: The word "bases" is the plural of "basis" and was used where there is more than one basis for taking action.

U.S. EPA 37. **Section 7.3.1.3, page 7-10:** Correct the typographical error in the second sentence (beginning with "The plan addresses...") of the second paragraph.

Comment response: The text has been revised to correct this error.

References:

EPA, 1989. Risk Assessment Guidance for Superfund: Volume 1: Human Health Evaluation Manual (Part A). Interim Final. December

EPA, 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils. Office of Solid Waste and Emergency Response. November.

EPA, 2003. Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53

Mather Five – Year Review

Appendix C

Response to State Comments

on the

Draft Final Revision

The Department of Toxic Substances Control (DTSC) and the Central Valley Regional Water Quality Control Board staff (Regional Board) have reviewed the "*Draft Final Five-Year Review*", dated June 7, 2004. The Air Force adequately responded to most of the agencies comments, but DTSC and the Regional Board have some remaining concerns that need to be addressed. These concerns are reflected in our comments below.

Comments

Comment 1: Institutional Controls, page 5-7, Section 5.3.2 Issues Identified by DTSC: Our understanding is that the Air Force is unwilling to amend the Records of Decision that selected the remedies for sites LF -03, LF -4, WP-07, OT-87, and OT-89 to include the requirement of State Land Use Covenants or operation, monitoring and maintenance of institutional controls. If this is not the Air Force's position please revise this section to clearly state the Air Force's position regarding institutional controls. DTSC will agree to not amend the RODs as long as the Air Force commits to signing a State Land Use Covenant and implementing the operation, monitoring and maintenance of the institutional controls in a primary document, such as design or Operation and Maintenance Plan. These documents must be in place before these sites are transferred.

Comment Response: The following text has replaced the second paragraph in Section 5.3.2:

The Air Force considers section 67391.1, subsections (a), (b), and (d), potential ARARs for selection of remedial actions. The Air Force also recognizes the potential value of adding state enforcement authority to the existing Air Force and EPA authorities in those instances, as here, where the remedy in place is protective and there is no current legal requirement to take that action. Accordingly, the Air Force is willing to consider supplementing the record of decision that is the subject of this five-year review, through a memo for the site record, or other means, to implement the appropriate provisions of section 673 91.1.

Comment 2: Gould well: DTSC recommends the Air Force modify the text on page 7-16 which states Air Force is not responsible for the contamination observed in the Gould well. Please state that it is now unclear who is responsible for the contamination. DTSC is aware of the fact that there are only a few monitoring wells in the area and those wells are not in the best locations to determine whether a connection to the Mather Mainbase Plume exists. The lack of data does mean the Air Force is not responsible. DTSC recommends within the next year the Air Force conduct an investigation to determine the source of the contamination. The commitment to do the investigation should be cited in the document.

Comment Response: The text does not state that the Air Force is not responsible; it states that the source of the contamination does not appear to be any known part of the Mather plumes. The Air Force position is that the low concentrations detected at the Gould Well, below the practical quantitation limit, do not warrant diversion of resources from cleanup

of the plume. The Air Force continues to monitor the Gould Well and the existing monitoring wells.

Comment 3: LUC/IC Plan: A recommendation to complete the Land Use Control/Institutional Control Management Plan (LUC/IC Plan) which should contain detailed information regarding operation, monitoring and maintenance of the institutional controls for sites LF-03, LF-04, WP-07, OT-87, OT-89 should be included in section 9.1. The text in this section should also state that the LUC/IC Plan is a primary document.

Comment Response: The text in Section 9.1 has been revised to state that the Air Force plans to complete a LUC/IC Plan. However the Plan's status as a primary or secondary document is subject to ongoing dispute resolution and will not be determined by this five-year review.

Comment 4: Statement on Protectiveness: On page 10-1 The Air Force should change Joel Jones to Kathleen Johnson and remove the word acting from her title.

Comment Response: The signature page has been revised as recommended.

Comment 5: Assessment of Aircraft Control and Warning (AC&W) Treatment System Remedy. The Air Force has not adequately evaluated the potential risks to human health and the environment associated with the discharge of treated water to Mather Lake from the AC&W Groundwater Treatment System. As explained in Regional Board comments on the Draft Review, data must be provided to determine if there is reasonable potential for the discharge to cause or contribute to an in stream excursion above a water quality objective for any United States Protection Agency Priority Pollutants or cause degradation of surface water quality. The Air Force should modify the text in Section 7.2.2 to include a more detailed evaluation of the AC&W Treatment System effluent and receiving water quality or a recommendation to submit a technical report, as required, to adequately support conclusions regarding the protectiveness of the AC&W remedy.

Comment Response: The five-year reviews completed in 1999 and 2004 have concluded that the remedy for the AC&W plume is protective. The remedial investigation evaluated the site for all suspected contaminants, and only trichloroethene was identified as a contaminant of concern. The remedy satisfies the ARARs identified in the Record of Decision and the Explanation of Significant Difference. The Air Force and the RWQCB do not agree on the applicability of the permit issued by the RWQCB and subsequent permit modification that would require additional sampling for constituents that have not been associated with the site.